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REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES,

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL,
MASSACHUSETTS,

DURING THE

FISCAL YEAR ENDED JUNE 30, 1901.

MARCH 22, 1902.—Referred to the Committee on Manufactures and ordered to be printed.

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1902.

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LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

REPORTS OF TESTS OF IRON, ETC., AT WATERTOWN ARSENAL.

War Department,
Washington, March 20, 1902.

Sir: I have the honor to transmit herewith, as required by law, copy of the report of the commanding officer of the Watertown Arsenal of "tests of iron, steel, and other materials for industrial purposes," made at the above-mentioned arsenal during the fiscal year ended June 30, 1901.

Very respectfully,

Elihu Root,
Secretary of War.

The Speaker of the House of Representatives.

Watertown Arsenal,
Watertown, Mass., March 15, 1902.

Sir: I have the honor to submit herewith the annual report of tests of iron and steel and other materials made at this arsenal during the fiscal year ending June 30, 1901.

The work of the testing department has been uninterrupted during the year, under the direct, intelligent supervision of J. E. Howard, C.E., in charge.

The total number of specimens tested during the year was 3,472, classified as follows:

Gun specimens	58
For Ordnance Department	635
For other Government Departments	112
Investigative tests	2, 459
Tests for private parties	478
Total	3, 742

12310

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$15,000.00
Received from private parties during the year	800.20
Total received	15,800.20
Amount expended for service and labor	13,152.77
Amount expended for light, power, tools, implements, and materials for test	2,647.43
Total expended	15,800.20

The tests on gun specimens have comprised metal representing the material used in current fabrication of the different caliber guns from the 3.6-inch B. L. field mortars to 12-inch B. L. steel rifles and rifled mortars. Test specimens were taken from the different component parts of these field, siege, and seacoast guns.

There were tensile tests on the steel used in the barrels of small arms, .30 caliber, and hydrostatic tests by means of interior pressure on the breech sections of the finished barrels.

Steel castings used in 6-pounder and 15-pounder gun mounts were tested by tension.

The behavior of the recoil mechanism of a 15-pounder field piece was the subject of experimental inquiry.

The examination of the state of internal strains in slices taken from the tubes of 5-inch R. F. guns has continued from the previous report. These internal strains are the result of treatment in which the metal at the bore is suddenly cooled from a moderately high temperature, which results in introducing internal strains in the tube, and which, in the final state of the cold tube, are strains of compression at and near the bore, while the exterior parts of the walls are left in a state of tension.

The tests on slices from guns in process of fabrication were supplemented by the examination of the strains in a specially prepared tube, treated in the same manner, by heating and quenching, as the gun tubes. In this test the comparative state of strains of the metal in the intact tube and in the detached slices were ascertained, tangential effects being compared.

The concomitant strains taken at right angles to the above, or in a longitudinal direction with reference to the axis of the gun, were also examined.

The strains introduced by this method of heat treatment are shown to be dislodged by moderate heating followed by slow cooling. The annealing effect of exposure to different temperatures followed by slow cooling formed a part of the investigation of this special tube.

There were tests of cast and pig irons, material from the arsenal foundry, anchor bolts for gun emplacements, proof stresses applied to piston rods for the carriages of seacoast guns, retraction chains, and retraction and buffer bracket hooks.

Compressive tests were made on double coil helical springs for 12-inch mortar carriages, and other springs of smaller dimensions used in current manufacture.

A number of tests of nickel-steel bars and steel plates are given in detail.

Steel eyebars, submitted by Mr. George S. Morison, C. E., were tested. There were tests of plain bars and comparison tests on spliced ones. The spliced bars had covering straps on each side, secured by means of bolts or rivets.

The effects of overstraining loads on wrought-iron bars were determined. These tests had reference to phenomena accompanying the exaltation of the elastic limit by overstraining loads, followed by an interval of rest. The examination included different grades of puddled iron, and overstraining loads of different magnitude were employed, followed by intervals of rest of long and short duration.

In addition to the exaltation of the elastic limit to be expected in tests of this kind, in further confirmation of this well-established feature it appeared from the results that the effects of these lower overstraining loads—i. e., where the elastic limit is but slightly exceeded—could be traced in the subsequent behavior of the metal up to loads nearly approaching, if not indeed coincident with, the ultimate tensile strength of the material.

Among other tests of a miscellaneous order are a number of bronze specimens, copper cylinders for pressure gauges in the determination of powder pressures in guns, cartridge cloth, paper, and a series of tests on a number of kinds of bricks submitted by the engineer commissioner of the District of Columbia.

In continuation of the tests of preceding reports there are results on concretes of arsenal manufacture 1 and 2 years old; also of some cement and concretes submitted by Mr. H. A. Carson, chief engineer of the Boston transit commission, and by Messrs. William Wirt Clarke & Son, Baltimore, Md.

An inquiry into the properties of cements has furnished some important information. The inquiry has been directed toward features which are regarded as possessing fundamental value in the physics of this class of material.

Beginning with the chemical analyses of the cements the tests have proceeded with observations on the fineness of grinding, specific gravity determinations on the ground material before and after hydration, and in the cake; determinations of the water held in hydrated material and carbon dioxide present; the rate of setting as influenced by the quantity of water used in gauging; the temperature acquired by large cubes of neat cement while setting, which it is shown may exceed the boiling point of water; tests on retarded sets, or when the cement has been held in the mortar bed different intervals before being allowed to set and indurate undisturbed, and also tests bearing on the so-called "second set" of cement.

A special lot of cement in which there was no sulphate of lime—the usual "restrainer" for controlling the rate of setting—was supplied through the courtesy of the Bonneville Portland Cement Company, and its behavior has been ascertained in conjunction with cement of the same manufacture in which the usual commercial mixture was represented.

A large number of tests have been made on Portland, slag, and natural cements which set in air at different temperatures. The facilities of a cold-storage warehouse were utilized for exposing one group of specimens to a temperature of about 0° F., another group to a temperature in the vicinity of 39° F., while a third group remained in the open air during the period of setting. The several groups were each exposed to their respective temperatures immediately after guaging.

The most interesting results pertained to the subsequent testing of the material which was exposed to zero temperature. Specimens which remained in storage one week, one month, or three months, followed by one or more days in the open air at 70° F., were low in strength in each group. The short initial period of setting between the time of guaging and when the material reached a frozen state and the final period of thawing, necessarily afforded an opportunity for the cement to acquire a certain degree of strength. The period of 0° F. was one of partial or perhaps nearly complete suspension of chemical action, as evinced by the strength displayed when finally tested. After thawing, the material rapidly gained in strength, but the evidence of the tests leads to the deduction that the interval of exposure to low temperature was detrimental in the subsequent attainment of strength when brought under ordinary atmospheric temperatures for the period of time covered by these experiments.

On the other hand, while the material which set at 39° F. did not equal the strength of that exposed to 70° F. for a corresponding period of time, yet the subsequent gain in strength after having been brought to 70° F. eventually placed it in a state of equality with the material set at the latter temperature only, and with instances in which there was a superiority in strength.

There were specimens subjected to higher temperatures, and the strength determined after they had cooled to the temperature of the open air.

The strength of glass, rough, ribbed, polished plate and wired, was determined in the condition of lights set in frames and under ordinary transverse loads. The limited available information on the strength of this material enhances the interest which attaches to these experiments.

Chemical analyses were made on the different classes of material, the results of which accompany the mechanical tests to which they refer, or are presented separately in tabular form.

A list of the private parties who have availed themselves of the facilities of the testing department during the fiscal year, under provision of the law, is appended.

The testing department building has been enlarged by the addition of a wing, providing rooms in which are located the engine and accumulator pump, the machine tools for the preparation of test pieces and the fabrication of special fixtures and supplementary parts of the testing machines, and a tank and furnace room, which is also used in the preparation of cement and concrete specimens.

This modified arrangement of the accessory apparatus of the testing department has enabled separate rooms in the main building to be set apart and used for metrology, photo-micrography, and pyrometry.

Very respectfully, your obedient servant,

John G. Butler,
Lieutenant-Colonel, Ordnance Department,
U. S. A., Commanding.

The Chief of Ordnance, U. S. A.,
Washington, D. C.

REPORT

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3.6-INCH B. L. FIELD MORTARS.

SPECIMENS FROM STEEL BODIES, BREECHBLOCKS, OBTURATING SPINDLES, AND GAS CHECKS.

BODIES.

Marks.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		″ ″
2	.505	.20	63,000	100,600	18.5	40.3	Silky, 60 per cent; granular, 40 per cent.	.27*, .10
3	.505	.20	63,000	107,500	16.0	34.0	Silky, 40 per cent; granular, 60 per cent.	.15, .17*
4	.505	.20	57,500	96,950	18.5	43.3	Silky	.10, .27*
5	.505	.20	64,000	108,100	19.5	37.1	.....do	.14, .25*
6	.505	.20	53,500	87,600	21.5	49.1	.....do	.11, .32*
7	.505	.20	57,000	99,750	18.5	37.1	.....do	.09, .28*
8	.505	.20	57,500	103,500	17.5	30.7	Silky, 30 per cent; granular, 70 per cent.	.10, .25*
9	.505	.20	54,000	98,250	20.5	30.7	Silky, 15 per cent; granular, 85 per cent.	.19, .22*
10	.505	.20	57,000	101,950	19.0	34.0	Silky, 30 per cent; granular, 70 per cent.	.18, .20*
11	.505	.20	64,000	103,250	19.5	37.1	Silky, 40 per cent; granular, 60 per cent.	.14, .25*
12	.505	.20	53,500	96,700	19.5	37.1	Silky, 60 per cent; granular, 40 per cent.	.12, .27*
13	.505	.20	54,000	106,600	18.0	27.4	Granular, silky spot at circumference.	.14, .22*
14	.505	.20	58,500	108,250	16.0	27.4	Granular, 80 per cent; silky, 20 per cent.	.10, .22*
15	.505	.20	60,000	111,500	17.0	27.4	Granular, 70 per cent; silky, 30 per cent.	.14, .20*
16	.505	.20	56,500	94,500	19.5	46.2	Silky	.09, .30*
17	.505	.20	57,500	106,500	17.5	30.7	Granular, 40 per cent; silky, 60 per cent, oblique.	.23*, .12
L	.564	.25	54,400	103,000	25.0	57.0	Silky, serrated[a]	.21, .29*
T	.564	.25	59,200	100,320	18.5	39.2	Granular, silky center[a].	.10, .27*

BREECHBLOCKS.

								″ ″
1	.505	.20	60,500	98,800	17.5	34.0	Silky, 80 per cent; fine granular, 20 per cent.	.10, .25*
2	.505	.20	61,200	98,400	18.5	34.0	Silky, oblique	.10, .27
3	.505	.20	74,750	102,350	17.5	34.0	Silky serrated, 85 per cent; granular, 15 per cent.	.25*, .10
4	.505	.20	65,000	106,000	22.5	49.1	Silky, cup-shaped	.31*, .14
5	.505	.20	61,000	100,600	14.5	34.0	Silky, 60 per cent; granular, 40 per cent.	.08, .21*

OBTURATING SPINDLES.

								″ ″ ″
1	.564	.25	73,600	98,000	22.0	61.5	Fine silky	.22, .37*, .09
2	.564	.25	62,720	85,680	25.7	61.5	.....do	.16, .46*, .15
3	.564	.25	58,520	83,760	23.7	67.8	.....do	.22, .40, .09
1	.505	.20	69,000	112,050	19.0	46.2	Silky	.10, .28*
2	.505	.20	60,500	112,700	18.5	46.2	.....do	.28*, .09
3	.505	.20	68,000	109,500	21.5	51.9	.....do	.30*, .13
4	.505	.20	64,750	107,500	19.5	40.3	.....do	.14, .25*
5	.505	.20	69,900	110,100	21.5	51.9	.....do	.10, .33*

GAS CHECKS.

								″ ″
	.564	.25	66,400	114,320	19.0	39.2	Granular, silky center	.11, .27*
	.564	.25	[b]120,000	145,600	8.5	15.0	Fine granular	.12*, .05
1	[c].505	.20	57,500	116,950	15.0	30.7	Silky, 10 per cent; fine granular, 90 per cent.	.07, .23*
2	[d].505	.20	62,000	109,000	21.5	51.9	Silky, 20 per cent; fine granular, 80 per cent.	.10, .33*
	.505	.20	81,000	150,000	11.0	20.5	Fine granular, silky spot at center.	.07, .15*

[a] Forgings, from billet. [b] Approximate. [c] Natural state of steel. [d] Same, oil treated.

5-INCH B. L. SIEGE RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 7291.

Marks, $\overset{A_{2}}{5\,T}\,B_{3}$.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
30,000	.00100	.00040	....	....	
35,000	.00115	.00015	0.	0.	
40,000	.00135	.00020	....	....	
42,000	.00140	.00005	0.	0.	
47,000	.00155	.00015	....	....	Elastic limit.
48,000	.00665	.00510	....	....	
49,000	.00810	.00145	....	....	
50,000	.00930	.00120	....	....	
51,000	.01005	.00075	....	....	
52,000	.01150	.00145	....	....	
81,700	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	**81,700**
Elastic limit per square inch of original section ....do...	**47,000**
Elongation per inch after rupture ....inch..	**.2550**
Elongation per inch under strain at elastic limit ....do...	**.00155**
Reduction in diameter at point of rupture ....do...	**.155**
Reduction in area after rupture, per cent of original section	**51.9**
Position of rupture	**".85 from neck**
Character of broken surface	**silky**
Elongation of inch sections	**".13, ".38***

TUBE.

No. 7323.

Marks, $\overset{C_4-5T}{B_1}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successi permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00040	.00025	....	....	
20,000	.00075	.00035	....	....	
30,000	.00110	.00035	....	....	
35,000	.00135	.00025	.00005	.00005	
40,000	.00150	.00015	....	....	
42,000	.00160	.00010	.00010	.00005	
45,000	.00170	.00010	....	....	Elastic limit.
46,000	.00190	.00020	....	....	
47,000	.00205	.00015	....	....	
48,000	.00225	.00020	....	....	
49,000	.00375	.00150	....	....	
50,000	.00500	.00125	....	....	
51,000	.00645	.00145	....	....	
52,000	.00750	.00105	....	....	
84,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	**pounds..**	**84,450**
Elastic limit per square inch of original section	**do...**	**45,000**
Elongation per inch after rupture	**inch..**	**.2200**
Elongation per inch under strain at elastic limit	**do...**	**.00170**
Reduction in diameter at point of rupture	**do...**	**.135**
Reduction in area after rupture, per cent of original section		**46.2**
Position of rupture		**1″ .1 from neck**
Character of broken surface		**silky**
Elongation of inch sections		**″.27*, ″.17**

JACKET.

No. 7365.

Marks, $\overset{C_{58}}{B_2}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.000967	.000334	....	....	
40,000	.001367	.000400	....	....	
46,000	.001567	.000200	0.	0.	
50,000	.001733	.000166	0.	0.	
51,000	.001800	.000067	....	....	Elastic limit not well defined.
52,000	.001900	.000100	....	....	
53,000	.002033	.000133	....	....	
54,000	.003367	.001334	....	....	
55,000	.004667	.001300	....	....	
56,000	.006033	.001366	....	....	
57,000	.006667	.000634	....	....	
58,000	.008000	.001333	....	....	
94,920	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section......pounds..	94,920
Elastic limit per square inch of original section......	not well defined
Elongation per inch after rupture......inch..	.2200
Reduction in diameter at point of rupture......do...	.134
Reduction in area after rupture, per centum of original section......	41.9
Position of rupture......	1″.6 from neck
Character of broken surface......	silky
Elongation of inch sections......	″.19, ″.35*, ″.12

TABULATION OF TENSION SPECIMENS FROM 5-INCH B. L. SIEGE RIFLES (STEMS OF SPECIMENS FROM TUBES, 2″ LONG, ″.505 DIAMETER).

No. of test.	Position in gun.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
		Pounds.	*Pounds.*	*Per ct.*	*Per ct.*		
7291	Tube	47,000	81,700	25.5	51.9	Silky........................	Breech end.
7323	....do....	45,000	84,450	22.0	46.2	.....do........................	Do.

STEMS OF SPECIMENS FROM JACKETS, 3″ LONG, ″.564 DIAMETER.

7365	Jacket...	Not well defined.	94,920	22.0	41.9	Silky........................	Breech end.

6-INCH R. F. GUNS.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 7292.

Marks, $\frac{\text{18381 B,}}{\text{B T, M}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00040	.00030	....	....	
20,000	.00070	.00030	....	....	
30,000	.00105	.00035	....	....	
40,000	.00135	.00030	0.	0.	
42,000	.00155	.00020	.00005	.00005	
44,000	.00165	.00010	....	....	Elastic limit.
45,000	.00215	.00050	....	....	
46,000	.00250	.00035	....	....	
47,000	.00350	.00100	....	....	
48,000	.00550	.00200	....	....	
49,000	.00650	.00100	....	....	
87,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,400
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.00165
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		″.6 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		″.14, ″.28*

TUBE.

No. 7296.

Marks, $^{6\,R\,F\,*\,T}_{M\,T_2\,M}$
Diameter, .″505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00100	.00040	....	....	
35,000	.00120	.00020	0.	0.	
40,000	.00145	.00025	....	....	
42,000	.00155	.00010	.00005	.00005	
49,000	.00180	.00025	....	....	Elastic limit.
50,000	.00245	.00065	....	....	
51,000	.00335	.00090	....	....	
52,000	.00440	.00105	....	....	
53,000	.00550	.00110	....	....	
54,000	.00645	.00095	....	....	
91,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,000
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2150
Elongation per inch under strain at elastic limit	do...	.00180
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.06 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.27*, ″.16

TUBE.

No. 7297.

Marks, $\begin{matrix}6\,R\,F_{37}\,T\\B\,T_2\,M\end{matrix}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00095	.00035	....	....	
35,000	.00110	.00015	0.	0.	
40,000	.00140	.00030	....	....	
42,000	.00150	.00010	0.	0.	
47,000	.00170	.00020	....	....	
48,000	.00180	.00010	....	....	Elastic limit.
49,000	.00200	.00020	....	....	
50,000	.00220	.00020	....	....	
51,000	.00295	.00075	....	....	
52,000	.00450	.00155	....	....	
53,000	.00710	.00260	....	....	
87,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	87,000
Elastic limit per square inch of original section	do	48,000
Elongation per inch after rupture	inch	.2350
Elongation per inch under strain at elastic limit	do	.00180
Reduction in diameter at point of rupture	do	.155
Reduction in area after rupture, per cent of original section		51.9
Position of rupture		″.75 from neck
Character of broken surface		silky
Elongation of inch sections		″.36*, ″.11

TUBE.

No. 7352.

Marks, $\overset{19721\ B_1}{M\ T_6\ M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
30,000	.00100	.00040	....	....	
35,000	.00115	.00015	0.	0.	
40,000	.00135	.00020	....	....	
42,000	.00145	.00010	0.	0.	Elastic limit.
43,000	.00500	.00355	....	....	
44,000	.01305	.00805	....	....	
45,000	.01350	.00045	....	....	
46,000	.01430	.00080	....	....	
47,000	.01500	.00070	....	....	
80,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,400
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2550
Elongation per inch under strain at elastic limit	do...	.00145
Reduction in diameter at point of rupture	do...	.194
Reduction in area after rupture, per cent of original section		57.0
Position of rupture		1.″1 from neck
Character of broken surface		silky, serrated
Elongation of inch sections		″.31*, ″.20

JACKET.

No. 7304.

Marks, $\overset{6\ R\ F_{38}\ J}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000033	.000033	0.	0.	
10,000	.000267	.000234	....	....	
20,000	.000633	.000366	....	....	
30,000	.000967	.000334	....	....	
40,000	.001300	.000333	0.	0.	
46,000	.001533	.000233	0.	0.	
50,000	.001700	.000167	....	....	
54,000	.001800	.000100	....	....	Elastic limit.
55,000	.001933	.000133	....	....	
56,000	.002167	.000234	....	....	
57,000	.004400	.002233	....	....	
58,000	.006000	.001600	....	....	
59,000	.006333	.000333	....	....	
95,680	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	95,680
Elastic limit per square inch of original section	do	54,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	.001800
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.95 from neck
Character of broken surface		silky
Elongation of inch sections		″.10, ″.14, ″.36*

JACKET.

No. 7305

Marks, $\begin{smallmatrix}6\ R\ F_g\ J\\ M\ T_1\ O\end{smallmatrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000067	.000067	0.	0.	
10,000	.000300	.000233	....	....	
20,000	.000667	.000367	....	....	
30,000	.001000	.000333	....	....	
40,000	.001333	.000333	0.	0.	
46,000	.001567	.000234	0.	0.	
50,000	.001700	.000133	....	....	
55,000	.001867	.000167	....	....	Elastic limit.
56,000	.002067	.000200	....	....	
57,000	.002333	.000266	....	....	
58,000	.002600	.000267	....	....	
59,000	.003067	.000467	....	....	
60,000	.004833	.001766	....	....	
101,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	101,600
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		″.95 from neck
Character of broken surface		silky
Elongation of inch sections		″.09, ″.14, ″32*

JACKET.

No. 7316.

Marks, $\begin{smallmatrix}18220\ B_1 \\ B\ T_2\ M\end{smallmatrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000267	.000167	....	....	
20,000	.000600	.000333	....	....	
30,000	.000933	.000333	....	....	
40,000	.001300	.000367	0.	0.	
46,000	.001533	.000233	0.	0.	
50,000	.001667	.000134	....	....	
53,000	.001767	.000100	....	....	
54,000	.001833	.000066	....	....	
55,000	.001900	.000067	....	....	Elastic limit.
56,000	.006500	.004600	....	....	
57,000	.006733	.000233	....	....	
58,000	.007667	.000934	....	....	
59,000	.008333	.000666	....	....	
60,000	.009333	.001000	....	....	
94,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	94,000
Elastic limit per square inch of original section....do...	55,000
Elongation per inch after rupture ....inch..	.2233
Elongation per inch under strain at elastic limit ....do...	.001900
Reduction in diameter at point of rupture....do...	.164
Reduction in area after rupture, per cent of original section....	49.7
Position of rupture	1″.62 from neck
Character of broken surface	silky
Elongation of inch sections	″.14, ″.38*, ″.15

JACKET.

No. 7353.

Marks, $^{18388\ B_2}_{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000667	.000367	....	....	
30,000	.001033	.000366	....	....	
40,000	.001367	.000334	....	....	
46,000	.001600	.000233	.000033	.000033	
50,000	.001700	.000100	....	....	
53,000	.001867	.000167	....	....	Elastic limit.
54,000	.003267	.001400	....	....	
55,000	.006333	.003066	....	....	
56,000	.008500	.002167	....	....	
57,000	.009333	.000833	....	....	
58,000	.010667	.001334	....	....	
89,120	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,120
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at the middle of the stem
Character of broken surface		silky
Elongation of inch sections		".10, ".33*, ".16

TABULATION OF TENSION SPECIMENS FROM 6-INCH R. F. GUNS.

STEMS OF SPECIMENS FROM TUBES 2" LONG, ".505 DIAMETER.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*		
7292	Tube	Middle .	44,000	87,400	21.0	30.7	Silky, oblique	Breech end.
7296	....do	....do ...	49,000	91,000	21.5	37.1	Silky, trace of granulation.	Muzzle end.
7297	....do	....do ...	48,000	87,000	23.5	51.9	Silky	Breech end.
7352	....do	....do ...	42,000	80,400	25.5	57.0	Silky, serrated......	Muzzle end.

STEMS OF SPECIMENS FROM JACKETS 3" LONG, ".564 DIAMETER.

7304	Jacket...	Outside.	54,000	95,680	20.0	49.7	Silky	Muzzle end.
7305	....do	....do ...	55,000	101,600	18.3	47.2	.....do	Do.
7316	....do	Middle .	55,000	94,000	22.3	49.7	.....do	Breech end.
7353	....do	....do ...	53,000	89,120	19.7	49.7	.....do	Do.

7-INCH B. L. SIEGE HOWITZERS.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 7322

Marks, $\frac{C\,7\,T}{B_2}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020			
20,000	.00070	.00035			
30,000	.00110	.00040			
35,000	.00125	.00015	.00005	.00005	
40,000	.00140	.00015			
42,000	.00150	.00010	.00005	0.	
50,000	.00180	.00030			
53,000	.00190	.00010			
54,000	.00195	.00005			Elastic limit.
55,000	.00850	.00655			
56,000	.00900	.00050			
57,000	.01025	.00125			
58,000	.01130	.00105			
59,000	.01275	.00145			
87,400					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,400
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.2500
Elongation per inch under strain at elastic limit	do...	.00195
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		″.90 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		″.36*, ″.14

TUBE.

No. 7379.

Marks, $C_{56}{}^{7\ T}_{B_2}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
30,000	.00100	.00040	....	....	
35,000	.00110	.00010	0.	0.	
40,000	.00125	.00015	....	....	
42,000	.00135	.00010	0.	0.	
49,000	.00155	.00020	....	....	Elastic limit.
50,000	.00300	.00145	....	....	
51,000	.00600	.00300	....	....	
52,000	.00750	.00150	....	....	
53,000	.00850	.00100	....	....	
54,000	.01000	.00150	....	....	
84,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	**pounds..**	**84,450**
Elastic limit per square inch of original section	**do...**	**49,000**
Elongation per inch after rupture	**inch..**	**.2750**
Elongation per inch under strain at elastic limit	**do...**	**.00155**
Reduction in diameter at point of rupture	**do...**	**.155**
Reduction in area after rupture, per cent of original section		**51.9**
Position of rupture		**at the middle of the stem**
Character of broken surface		**fine silky**
Elongation of inch sections		**″.32*, ″.23**

JACKET.

No. 7251.

Marks, $\frac{A_{10}\ 7\ J}{B_3}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads, per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial loads.
5,000	.000067	.000067	0.	0.	
10,000	.000267	.000200	....	....	
20,000	.000600	.000333	....	....	
30,000	.000967	.000367	....	....	
40,000	.001333	.000366	0.	0.	
46,000	.001600	.000267	0.	0.	
48.000	.001700	.000100	....	....	
49,000	.001700	0.	....	....	
50,000	.001767	.000067	....	....	
51,000	.001800	.000083	....	....	Elastic limit.
52,000	.002000	.000200	....	....	
53,000	.002483	.000483	....	....	
54,000	.002867	.000434	....	....	
55,000	.003600	.000733	....	....	
56,000	.005000	.001400	....	....	
57,000	.006000	.001000	....	....	
90,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,400
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inches..	.2100
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.30 from neck
Character of broken surface		silky
Elongation of inch sections		″.20, ″.81*, ″.12

JACKET.

No. 7378.

Marks $^{C\ 60-1\ 7\ J}_{B_1}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.000967	.000334	....	....	
40,000	.001300	.000333	0.	0.	
46,000	.001500	.000200	0.	0.	
50,000	.001667	.000167	....	....	
60,000	.002000	.000333	....	....	
64,000	.002133	.000133	....	....	Elastic limit.
65,000	.002300	.000167	....	....	
66,000	.002500	.000200	....	....	
67,000	.002700	.000200	....	....	
68,000	.004333	.001633	....	....	
69,000	.005667	.001334	....	....	
70,000	.008000	.002333	....	....	
103,560	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................pounds.. 103,560
Elastic limit per square inch of original section....................do... 64,000
Elongation per inch after rupture....................inches.. .177
Elongation per inch under strain at elastic limit....................do... .002133
Reduction in diameter at point of rupture....................do... .144
Reduction in area after rupture, per cent of original section.................... 44.6
Position of rupture.................... 1″.27 from neck
Character of broken surface.................... silky
Elongation of inch sections.................... ″.10, ″.26*, ″.17

TABULATION OF TENSION SPECIMENS FROM 7-INCH B. L. SIEGE HOWITZERS.

STEMS OF SPECIMENS FROM TUBES, 2″ LONG, ″.505 DIAMETER.

No. of test.	Position in gun.	Elastic limit, per square inch.	Tensile strength, per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
		Pounds.	*Pounds.*	*Per cent.*	*Per cent.*		
7322	Tube	54,000	87,400	25.0	54.6	Silky, oblique	Breech end.
7379	....do....	49,000	84,450	27.5	51.9	Fine silky	Do.

STEMS OF SPECIMENS FROM JACKETS, 3″ LONG, ″.505 DIAMETER.

7251	Jacket...	51,000	90,400	21.0	49.7	Silky....................	Breech end.
7378	....do....	64,000	103,560	17.7	44.6	.....do....................	Do.

10-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 7404.

Marks, $\frac{19610\ \mathrm{B}_3}{\mathrm{M\ T}_3\ \mathrm{M}}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001367	.000200	0.	0.	
50,000	.001700	.000333	....	....	Elastic limit.
51,000	.009667	.007967	....	....	
52,000	.011000	.001333	....	....	
53,000	.012167	.001167	....	....	
54,000	.012667	.000500	....	....	
55,000	.013667	.001000	....	....	
84,960	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,960
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.88*, ″.17

JACKET.

No. 7372

Marks, $\begin{matrix}19557\ B_8\\ B\ T_2\ M\end{matrix}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100			
10,000	.000300	.000200			
20,000	.000633	.000333			
30,000	.000967	.000344	0.	0.	
35,000	.001133	.000166			
40,000	.001333	.000200	0.	0.	
42,000	.001400	.000067			
49,000	.001633	.000233			
50,000	.001700	.000067			Elastic limit.
51,000	.006867	.005167			
52,000	.007400	.000533			
53,000	.008133	.000733			
54,000	.009200	.001067			
55,000	.010067	.000867			
90,360					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,360
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1".35 from neck
Character of broken surface		fine granular, 50 per cent; silky, 50 per cent
Elongation of inch sections		".15, ".30, ".13

JACKET.

No. 7383.

Marks, $^{15598\ B_2}_{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch
Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200			
20,000	.000533	.000333			
30,000	.000967	.000334			
35,000	.001133	.000166	0.	0.	
40,000	.001300	.000167			
42,000	.001367	.000067	0.	0.	
50,000	.001633	.000266			
53,000	.001767	.000134			Elastic limit.
54,000	004000	.002233			
55,000	.005000	.001000			
56,000	.005833	.000833			
57,000	.006667	.000834			
58,000	.007333	.000666			
96,720					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,720
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".4 from neck
Character of broken surface		silky
Elongation of inch sections		".16, ".29*, ".15

TABULATION OF TENSION SPECIMENS FROM 10-INCH B. L. RIFLES.

STEMS OF SPECIMENS, 3" LONG, ".564 DIAMETER.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*		
7404	Tube	Middle .	50,000	84,960	23.7	49.7	Silky	Muzzle end.
7372	Jacket...	....do...	50,000	90,360	19.3	33.5	Fine granular, 50 per cent; silky, 50 cent.	Breech end.
7383	....do....	....do...	53,000	96,720	20.0	44.6	Silky	Do.

12-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 7283.

Marks, $\substack{\text{16000 B,}\\ \text{M T, M}}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000067	.000067	0.	0.	
10,000	.000300	.000233	....	....	
20,000	.000667	.000367	....	....	
30,000	.001033	.000366	....	....	
35,000	.001167	.000134	....	....	
40,000	.001367	.000200	0.	0.	
49,000	.001700	.000333	....	....	Elastic limit.
50,000	.004333	.002633	....	....	
51,000	.004967	.000634	....	....	
52,000	.005933	.000966	....	....	
53,000	.006667	.000734	....	....	
54,000	.007600	.000933	....	....	
91,360	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,360
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.6 inch from neck
Character of broken surface		Silky
Elongation of inch sections		″.13, ″.34*, ″.16

TUBE.

No. 7362.

Marks, $\overset{15938\ B_2}{B\ T_3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001200	.000200	0.	0.	
40,000	.001367	.000167	0.	0.	
44,000	.001500	.000133	....	....	
45,000	.001567	.000067	....	....	Elastic limit.
46,000	.002700	.001133	....	....	
47,000	.004000	.001300	....	....	
48,000	.005600	.001600	....	....	
49,000	.006167	.000567	....	....	
50,000	.007333	.001166	....	....	
87,120	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	87,120
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.2233
Elongation per inch under strain at elastic limit	do	.001567
Reduction in diameter at point of rupture	do	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.4 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		″.26, ″.28*, ″.13

TUBE.

No. 7363.

Marks, $\substack{12\ R_{56}\ T \\ M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.000967	.000334	....	....	
35,000	.001100	.000133	0.	0.	
40,000	.001300	.000200	0.	0.	
44,000	.001433	.000133	....	....	Elastic limit.
45,000	.010667	.009234	....	....	
46,000	.011067	.000400	....	....	
47,000	.011667	.000600	....	....	
48,000	.012933	.001266	....	....	
49,000	.013783	.000800	....	....	
81,200	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,200
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″ from neck
Character of broken surface		silky
Elongation of inch sections		″.37*, ″.21, ″.16

JACKET.

No. 7252.

Marks, $\frac{16768\ B_1}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000667	.000367	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001333	.000165	....	....	
42,000	.001400	.000067	0.	0.	
50,000	.001700	.000300	....	....	
51,000	.001733	.000033	....	....	Elastic limit.
52,000	.003667	.001934	....	....	
53,000	.004300	.000633	....	....	
54,000	.004833	.000533	....	....	
55,000	.005400	.000567	....	....	
56,000	.006333	.000933	....	....	
100,640	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	100,640
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.203
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".13, ".34*, ".14

JACKET.

No. 7355.

Marks. $\begin{matrix}15965\ B_1 \\ M\ T_2\ M\end{matrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001367	.000200	....	....	
42,000	.001467	.000100	0.	0.	
48,000	.001667	.000200	....	....	Elastic limit.
49,000	.003667	.002000	....	....	
50,000	.004667	.001000	....	....	
51,000	.005400	.000733	....	....	
52,000	.006300	.000900	....	....	
53,000	.006667	.000367	....	....	
94,360	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,360
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″ from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.21, ″.35*

JACKET.

No. 7364.

Marks, $\genfrac{}{}{0pt}{}{12\ R_{56}\ J}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200			
20,000	.000633	.000333			
30,000	.001000	.000367			
35,000	.001133	.000133	0.	0.	
40,000	.001333	.000200			
42,000	.001433	.000100	0.	0.	
51,000	.001733	.000300			Elastic limit.
52,000	.002667	.000934			
53,000	.004333	.001666			
54,000	.009333	.005000			
55,000	.009667	.000334			
56,000	.010067	.000400			
88,720					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,720
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		at the middle of the stem
Character of broken surface		fine silky
Elongation of inch sections		″.12, ″.43*, ″14

TABULATION OF STEEL TENSION SPECIMENS FROM 12-INCH B. L. RIFLES.

STEMS OF SPECIMENS, 3″ LONG, ″.564 DIAMETER.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensil strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Pr. ct.*	*Pr. ct.*		
7283	Tube	Middle .	49,000	91,360	21.0	41.9	Silky	Muzzle end.
7362	...do.....	...do....	45,000	87,120	22.3	41.9	.....do	Breech end.
7363	...do.....	...do....	44,000	81,200	24.7	47.2	.....do	Muzzle end.
7252	Jacket...	...do....	51,000	100,640	20.3	39.2	.....do	Breech end.
7355	...do.....	...do....	48,000	94,360	23.3	44.6	.....do	Muzzle end.
7364	...do.....	Outside.	51,000	88,720	23.0	54.6	Fine silky	Do.

12-INCH STEEL B. L. RIFLED MORTARS.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 7303.

Marks, $^{12\ M\ R_{113}\ T}_{B\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000067	.000067	....	....	
10,000	.000333	.000266	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	.000033	.000033	
40,000	.001367	.000200	.000033	0.	
51,000	.001700	.000333	....	....	Elastic limit.
52,000	.001933	.000233	....	....	
53,000	.002333	.000400	....	....	
54,000	.003267	.000934	....	....	
55,000	.004000	.000733	....	....	
56,000	.004667	.000667	....	....	
90,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,400
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1033
Elongation per inch under strain at elastic limit	do...	.001700
Position of rupture	specimen not fractured; stripped thread on head. The head was too short to give adequate strength for testing.	

TUBE.

No. 7354.

Marks, $\genfrac{}{}{0pt}{}{19609\ B_4}{B\ T_3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000267	.000167	....	....	
20,000	.000667	.000400	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001333	.000166	0.	0.	
50,000	.001667	.000334	....	....	
55,000	.001867	.000200	....	....	Elastic limit.
56,000	.002333	.000466	....	....	
57,000	.003000	.000667	....	....	
58,000	.006333	.003333	....	....	
59,000	.006833	.000500	....	....	
60,000	.007333	.000500	....	....	
100,480	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	100,480
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.2 from neck
Character of broken surface		granular 50 per cent, silky 50 per cent
Elongation of inch sections		″.12, ″.20, ″.24*

TUBE.

No. 7370.

Marks, $\substack{19524\ B_3 \\ B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000600	.000300	....	....	
30,000	.000967	.000367	....	....	
35,000	.001100	.000133	0.	0.	
40,000	.001300	.000200	0.	0.	
50,000	.001700	.000400	....	....	
51,000	.001733	.000033	....	....	Elastic limit.
52,000	.005267	.003534	....	....	
53,000	.005667	.000400	....	....	
54,000	.006667	.001000	....	....	
55,000	.007333	.000666	....	....	
56,000	.008433	.001100	....	....	
92,320	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,320
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		″.9 from neck
Character of broken surface		granular, dull silky spot at circumference
Elongation of inch sections		″.15, ″.18, ″.22*

TUBE.

No. 7402.

Marks, $\substack{12\ M\ R_{124}\ T \\ M\ T_5\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive Permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001333	.000166	0.	0.	
50,000	.001667	.000334	....	....	
55,000	.001867	.000200	....	....	Elastic limit.
56,000	.005333	.003466	....	....	
57,000	.006433	.001100	....	....	
58,000	.007833	.001400	....	....	
59,000	.008667	.000834	....	....	
60,000	.010000	.001333	....	....	
92,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds	92,400
Elastic limit per square inch of original section	do	55,000
Elongation per inch after rupture	inch	.1967
Elongation per inch under strain at elastic limit	do	.001867
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.9 from neck
Character of broken surface		silky
Elongation of inch sections		″.38*, ″.13, ″.08

TUBE.

No. 7403.

Marks, $\begin{array}{l}12\ M\ R_{138}\ T\\ M\ T_1\ O\end{array}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001333	.000166	0.	0.	
50,000	.001700	.000367	....	....	
55,000	.001867	.000167	....	....	Elastic limit.
56,000	.002000	.000133	....	....	
57,000	.021000	.009000	....	....	
58,000	.022833	.001833	....	....	
59,000	.024167	.001334	....	....	
60,000	.026333	.002166	....	....	
80,080	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	80,080
Elastic limit per square inch of original section .... do...	55,000
Elongation per inch after rupture .... inch..	.2600
Elongation per inch under strain at elastic limit .... do...	.001867
Reduction in diameter at point of rupture .... do...	.174
Reduction in area after rupture, per cent of original section	52.2
Position of rupture	1″.5 from neck
Character of broken surface	silky
Elongation of inch sections	″.20, ″.42*, ″.16

TUBE.

No. 7406.

Marks, $^{19213\ B_1}_{BT_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001333	.000166	0.	0.	
45,000	.001533	.000200	....	....	Elastic limit.
46,000	.008667	.007134	....	....	
47,000	.009500	.000833	....	....	
48,000	.010567	.001067	....	....	
49,000	.011667	.001100	....	....	
50,000	.012567	.000900	....	....	
81,680	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,680
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		″.70 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.15, ″.36

JACKET.

No. 7298.

Marks, $\begin{matrix}12\ \mathrm{MR}_{113}\ \mathrm{J}\\ \mathrm{MT}_1\ \mathrm{O}\end{matrix}$
Diameter, ".569.
Sectional area, .254 square inch.
Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000667	.000367	....	....	
30,000	.001033	.000366	....	....	
35,000	.001267	.000234	.000033	.000033	
40,000	.001533	.000266	....	....	
42,000	.001600	.000067	.000067	.000034	
49,000	.001800	.000200	....	....	Elastic limit.
50,000	.002167	.000367	....	....	
51,000	.002333	.000166	....	....	
52,000	.002500	.000167	....	....	
53,000	.003300	.000800	....	....	
54,000	.004500	.001200	....	....	
92,090	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	92,090
Elastic limit per square inch of original section........................do...	49,000
Elongation per inch after rupture ....inch..	.2200
Elongation per inch under strain at elastic limit........................do...	.001800
Reduction in diameter at point of rupture........................do...	.149
Reduction in area after rupture, per cent of original section	45.5
Position of rupture	".95 from neck
Character of broken surface........................	silky
Elongation of inch sections........................	".35*, ".18, ".13

JACKET.

No. 7306.

Marks, $\overset{17796\ B_4}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000067	.000067	0.	0.	
10,000	.000333	.000266	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001133	.000133	0.	0.	
40,000	.001333	.000200	....	....	
42,000	.001400	.000067	0.	0.	
50,000	.001667	.000267	....	....	
53,000	.001767	.000100	....	....	Elastic limit.
54,000	.013667	.011900	....	....	
55,000	.014333	.000666	....	....	
56,000	.015400	.001067	....	....	
57,000	.016333	.000933	....	....	
58,000	.017400	.001067	....	....	
88,960	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,960
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.20. ″.33*, ″.19

JACKET.

No. 7356.

Marks, $\overset{12\ \mathrm{M}\ \mathrm{R}_{117}\ \mathrm{J}}{\mathrm{B}\ \mathrm{T}_1\ \mathrm{O}}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.001000	.000367	....	....	
35,000	.001167	.000167	0.	0.	
40,000	.001333	.000166	....	....	
42,000	.001400	.000067	....	....	
50,000	.001700	.000300	....	....	
51,000	.001767	.000067	....	....	Elastic limit.
52,000	.001933	.000166	....	....	
53,000	.002433	.000500	....	....	
54,000	.005433	.003000	....	....	
55,000	.006667	.001234	....	....	
56,000	.008000	.001333	....	....	
89,880	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	89,880
Elastic limit per square inch of original section .... do...	51,000
Elongation per inch after rupture .... inch..	.1967
Elongation per inch under strain at elastic limit .... do...	.001767
Reduction in diameter at point of rupture .... do...	.114
Reduction in area after rupture, per cent of original section	36.4
Position of rupture	1″.3 from neck
Character of broken surface	silky, with granular spot on one side
Elongation of inch sections	″.14, ″.28*, ″.17

JACKET.

No. 7357.

Marks, $^{12\ M\ R_{118}\ J}_{B\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001033	.000366	....	....	
35,000	.001200	.000167	.000033	.000033	
40,000	.001367	.000167	....	....	
42,000	.001433	.000066	.000033	0.	
49,000	.001733	.000300	....	....	Elastic limit.
50,000	.002000	.000267	....	....	
51,000	.002333	.000333	....	....	
52,000	.003333	.001000	....	....	
53,000	.006333	.003000	....	....	
54,000	.007933	.001600	....	....	
87,200	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,200
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of broken surface		″.9 from neck
Character of rupture		silky
Elongation of inch sections		″.38*, ″.15, ″.12

JACKET.

No. 7371.

Marks, $\overset{19302\ B_3}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10.000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.001000	.000361	....	....	
85,600	.001167	.000167	0.	0.	
40.000	.001333	.000166	....	....	
42,000	.001400	.000067	0.	0.	
50,000	.001700	.000300	....	....	
51,000	.001733	.000033	....	....	Elastic limit.
52.000	.006333	.004600	....	....	
53,000	.006667	.000334	....	....	
54,000	.008000	.001333	....	....	
55,000	.008833	.000833	....	....	
56,000	.010167	.001334	....	....	
88,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds..	88,400
Elastic limit, per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.25 from neck
Character of broken surface		silky
Elongation of inch sections		″.28, ″.33*, ″.16

JACKET.

No. 7405.

Marks, $\overset{20095\ B,}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000133	.000133	0.	0.	
10,000	.000333	.000200	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
35,000	.001200	.000200	0.	0.	
40,060	.001367	.000167	....	....	
42,000	.001433	.000066	0.	0.	
50,000	.001700	.000267	....	....	
51,000	.001767	.000067	....	....	Elastic limit.
52,000	.008833	.007066	....	....	
53,000	.009167	.000334	....	....	
54,000	.009667	.000500	....	....	
55,000	.010667	.001000	....	....	
56,000	.011833	.001166	....	....	
91,680	....	....	....	....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds	91,680
Elastic limit, per square inch of original section	do	51,000
Elongation per inch after rupture	inch	.2167
Elongation per inch under strain at elastic limit	do	.001767
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.05 from neck
Character of broken surface		silky
Elongation of inch sections		″.37*, ″.16, ″.12

TABULATION OF STEEL TENSION SPECIMENS FROM 12-INCH STEEL B. L. RIFLED MORTARS.

STEMS OF SPECIMENS, 3″ LONG, ″.564 DIAMETER.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*		
7303	Tube	Outside.	51,000	a 90,400	10.3	....	....	Breech end.
7354	....do....	Middle .	55,000	100,480	18.7	39.2	Granular, 50 per cent; silky, 50 per cent.	Do.
7370	....do....	....do...	51,000	92,320	18.3	24.6	Granular	Do.
7402	....do....	Outside.	55,000	92,400	19.7	49.7	Silky	Muzzle end.
7403	....do....	....do...	55,000	80,080	26.0	52.2	.....do..............	Do.
7406	....do....	Middle .	45,000	81,680	21.3	47.2	.....do..............	Breech end.
7298	Jacket...	Outside.	49,000	92,090	22.0	45.5	.....do..............	Muzzle end.
7306	....do....	Middle .	53,000	88,960	24.0	49.7	.....do..............	Do.
7356	....do....	Outside.	51,000	89,880	19.7	36.4	Silky, granular spot	Breech end.
7357	....do....	....do...	49,000	87,200	21.7	49.7	Silky	Do.
7371	....do....	Middle .	51,000	88,400	24.0	49.7	.....do..............	Do.
7405	....do....	....do...	51,000	91,680	21.7	49.7	.....do..............	Muzzle end.

a Specimen not fractured; stripped the thread on head.

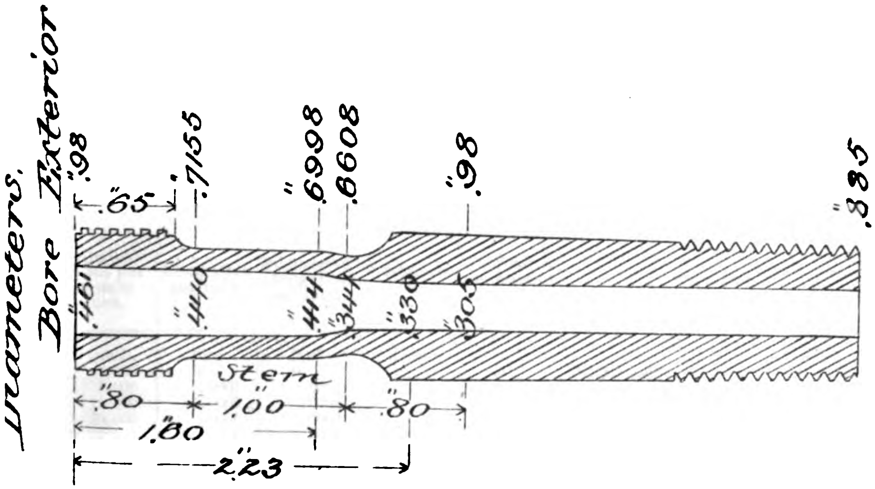
GAS CHECK DISKS FOR 12-INCH STEEL B. L. RIFLE.

Marks.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	Inches.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		″ ″
1	.505	.20	75,500	145,100	14.0	27.4	Fine granular, silky spot..	.20*, .08
2	.505	.20	94,500	162,900	6.5	9.5	Fine granular, silky spot at circumference.	.05, .08*
4	.505	.20	76,500	152,500	11.5	16.9	Fine granular, silky spot..	.08, .15
6	.505	.20	75,000	143,750	13.0	16.9	.....do......................	* .10, .16

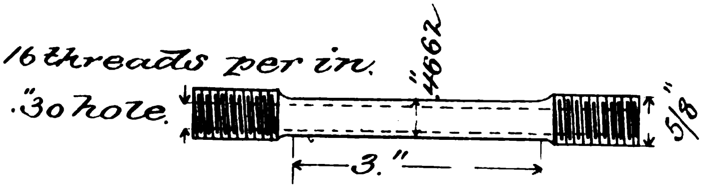
RIFLE-BARREL STEEL, .30 CALIBER.

.30 caliber rifle barrels.

Specimens from bar and butt ends.
Sectional area .25 sq. inch



Specimens from middle of lengths.
Sectional area .10 sq. in.



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SPECIMENS FROM RIFLE BARRELS, FROM SPRINGFIELD ARMORY.

The specimens marked M 3 D represent the steel in the bar.

Those marked M 3 A, M 3 B, and M 3 C, two sets, were taken from finished barrels, one set from the butts over the powder chamber; the other set were taken farther up the barrels, near the middle of their lengths.

Specimens carrying the letter A came from barrels which were annealed after rolling, according to the usual practice at the armory.

Those marked with the letter B were from barrels rolled and annealed at their residual heat, while specimens C were cooled in the air after rolling.

Hydrostatic tests of sections over the powder chambers were made on barrels from each of the three lots above mentioned, the results of which follow the details and tabulation of these tensile tests.

No. 7399.

Marks, M 3 D.
Sectional area .25 square inch.
Gauged length, 1″.
Specimen from the bar.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.0001	.0001			
10,000	.0003	.0002			
20,000	.0006	.0003			
30,000	.0010	.0004			
40,000	.0014	.0004			
50,000	.0017	.0003			
60,000	.0021	.0004	0.	0.	
70,000	.0025	.0004			
75,000	.0029	.0004			Elastic limit.
76,000	.0058	.0029			
77,000	.0075	.0017			
78,000	.0090	.0015			
80,000	.0115	.0025			
84,000	.0150	.0035			
88,000	.0190	.0040			
92,000	.0230	.0040			
100,000	.04	.017			
108,000	.05	.01			
116,000	.08	.03			
118,880					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,880
Elastic limit per square inch of original section	do...	75,000
Elongation per inch after rupture	inch..	.23
Elongation per inch under strain at elastic limit	do...	.0029
Character of broken surface		fine granular 60 per cent, silky 40 per cent

No. 7400.

Marks, M 3 D.
Sectional area, .25 square inch.
Gauged length, 1″.
Specimen from the bar.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.0001	.0001			
10,000	.0004	.0003			
20,000	.0007	.0003			
30,000	.0010	.0003			
40,000	.0013	.0003			
50,000	.0018	.0005			
58,000	.0020	.0002			
59,000	.0022	.0002			Elastic limit.
60,000	.0125	.0103			
61,000	.0136	.0011			
62,000	.0143	.0007			
64,000	.0160	.0017			
68,000	.0200	.0040			
72,000	.0245	.0045			
76,000	.03	.005			
80,000	.04	.01			
88,000	.06	.02			
96,000	.10	.04			
97,600					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,600
Elastic limit per square inch of original section	do....	59,000
Elongation per inch after rupture	inch..	.20
Elongation per inch under strain at elastic limit	do....	.0022
Character of broken surface		granular 50 per cent, silky 50 per cent

No. 7401.

Marks, M 3 D.
Sectional area, .25 square inch.
Gauged length, 1″.
Specimen from the bar.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.0001	.0001	....	....	
10,000	.0004	.0003	....	....	
20,000	.0007	.0003	....	....	
30,000	.0010	.0003	....	....	
40,000	.0013	.0003	....	....	
50,000	.0016	.0003	....	....	
60,000	.0020	.0004	0.	0.	
70,000	.0023	.0003	....	....	
73,000	.0025	.0002	....	....	Elastic limit.
74,000	.0053	.0028	....	....	
75,000	.0068	.0015	....	....	
76,000	.0080	.0012	....	....	
78,000	.0100	.0020	....	....	
80,000	.0120	.0020	....	....	
84,000	.0155	.0035	....	....	
88,000	.0190	.0035	....	....	
92,000	.0230	.0040	....	....	
100,000	.04	.017	....	....	
108,000	.05	.01	....	....	
116,000	.09	.04	....	....	
118,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,400
Elastic limit per square inch of original section	do....	73,000
Elongation per inch after rupture	inch..	.18
Elongation per inch under strain at elastic limit	do....	.0025
Character of broken surface		granular 80 per cent, silky 20 per cent

No. 7393.

Marks, M 3 A.
Sectional area, .25 square inch.
Gauged length, 1″.
From butt of finished barrel.
Rolled and annealed as usual.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.0002	.0002	....	....	
10,000	.0004	.0002	....	....	
20,000	.0007	.0003	....	....	
30,000	.0010	.0003	....	....	
40,000	.0014	.0004	....	....	
50,000	.0018	.0004	....	....	
60,000	.0022	.0004	0.	0.	
68,000	.0026	.0004	....	....	Elastic limit.
69,000	.0051	.0025	....	....	
70,000	.0065	.0014	....	....	
71,000	.0075	.0010	....	....	
72,000	.0093	.0018	....	....	
76,000	.0135	.0042	....	....	
80,000	.0187	.0052	....	....	
84,000	.0230	.0043	....	....	
88,000	.0292	.0062	....	....	
92,000	.04	.011	....	....	
96,000	.05	.01	....	....	
100,000	.06	.01	....	....	
108,160	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	108,160
Elastic limit per square inch of original section	do...	68,000
Elongation per inch after rupture	inch..	.26
Elongation per inch under strain at elastic limit	do...	.0026
Character of broken surface		silky, cup-shaped

No. 7398.

Marks, M 3 C.
Sectional area, .25 square inch.
Gauged length, 1″.
From butt of finished barrel.
Rolled, and cooled in the air.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.0001	.0001	....	....	
10,000	.0003	.0002	....	....	
20,000	.0006	.0003	....	....	
30,000	.0009	.0003	....	....	
40,000	.0012	.0003	....	....	
50,000	.0016	.0004	....	....	
60,000	.0020	.0004	....	....	
70,000	.0025	.0005	....	....	
76,000	.0028	.0003	....	....	Elastic limit.
77,000	.0080	.0052	....	....	
78,000	.0130	.0050	....	....	
79,000	.0155	.0025	....	....	
80,000	.0167	.0012	....	....	
82,000	.0187	.0020	....	....	
84,000	.0205	.0018	....	....	
88,000	.03	.01	....	....	
92,000	.04	.01	....	....	
100,000	.05	.01	....	....	
108,000	.08	.03	....	....	
113,200	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	113,200
Elastic limit per square inch of original section	do...	76,000
Elongation per inch after rupture	inch..	.21
Elongation per inch under strain at elastic limit	do...	.0028
Character of broken surface		fine granular 40 per cent, silky 60 per cent

No. 7387.

Marks, M 3 A.
Exterior diameter, ″.466.
Interior diameter, .300.
Sectional area, .10 square inch.
Gauged length, 3″.
From middle of length of finished barrel.
Rolled and annealed as usual.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233			
20,000	.000667	.000334			
30,000	.001000	.000333			
40,000	.001367	.000367			
50,000	.001667	.000300			
60,000	.002033	.000366	0.	0.	
70,000	.002433	.000400			
80,000	.002800	.000367	0.	0.	
87,000	.003067	.000267			Elastic limit.
88,000	.003200	.000133			
89,000	.036333	.033133			
90,000	.038000	.001667			
94,000	.0500	.0120			
100,000	.0700	.0200			
106,200					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,200
Elastic limit per square inch of original section	do...	87,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain of elastic limit	do...	.003067
Reduction in external diameter at point of rupture	do...	.116
Position of rupture		1.″5 from neck
Character of broken surface		silky, cup-shaped
Elongation of inch sections		″.13, ″.32*. ″.15

No. 7388.

Marks, M 3 A.
Exterior diameter, ″.466.
Interior diameter, ″.300.
Sectional area, .10 square inch.
Gauged length, 3″.
From middle of length of finished barrel, rolled and annealed as usual.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000667	.000367	....	....	
30,000	.001033	.000366	....	....	
40,000	.001367	.000334	....	....	
50,000	.001733	.000366	....	....	
60,000	.002033	.000300	0.	0.	
61,000	.002100	.000067	....	....	Elastic limit.
62,000	.022300	.020200	....	....	
63,000	.023667	.001367	....	....	
64,000	.024667	.001000	....	....	
66,000	.026900	.002233	....	....	
68,000	.029000	.002100	....	....	
72,000	.035833	.006833	....	....	
76,000	.044000	.008167	....	....	
80,000	.053333	.009333	....	....	
84,000	.0767	.0234	....	....	
88,000	.1067	.0300	....	....	
90,200	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,200
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in external diameter at point of rupture	do...	.116
Position of rupture		1″.26 from neck
Character of broken surface		silky, cup-shaped
Elongation of inch sections		″.26*, ″.26*, ″.14

No. 7389.

Marks M 3 B.
Exterior diameter, ″.466.
Interior diameter, ″.300.
Sectional area, .10 square inch.
Gauged length 3.″
From middle of length of finished barrel. rolled and annealed at residual heat.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.001000	.000367	....	....	
40,000	.001333	.000333	....	....	
50,000	.001667	.000334	....	....	
60,000	.002000	.000333	0.	0.	
70,000	.002333	.000333	....	....	
80,000	.002700	.000367	....	....	
90,000	.003033	.000333	....	....	
93,000	.003167	.000134	....	....	Elastic limit.
94,000	.028000	.024833	....	....	
95,000	.029333	.001333	....	....	
96,000	.030500	.001167	....	....	
98,000	.033433	.002933	....	....	
100,000	.037333	.003983	....	....	
105,000	.0467	.0094	....	....	
110,000	.0633	.0166	....	....	
115,000	.0933	.0300	....	....	
117,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section..........pounds..	117,400
Elastic limit per square inch of original section..........do...	93,000
Elongation per inch after rupture..........inch..	.1800
Elongation per inch under strain at elastic limit..........do...	.003167
Reduction in external diameter at point of rupture..........do...	.106
Postion of rupture..........	″.95 from neck
Character of broken surface..........	silky, cup-shaped
Elongation of inch sections..........	″.27*, ″.16, ″.11

No. 7390.

Marks, M 3 B.
Exterior diameter, ″.466.
Interior diameter, ″.300.
Sectional area, .10 square inch.
Gauged length, 3″.
From middle of length of finished barrel.
Rolled, and annealed at residual heat.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.001000	.000367	....	....	
40,000	.001333	.000333	....	....	
50,000	.001700	.000367	....	....	
60,000	.002033	.000333	0.	0.	
70,000	.002367	.000334	....	....	
80,000	.002700	.000333	....	....	
90,000	.003033	.000333	....	....	
91,000	.003067	.000034	....	....	Elastic limit.
92,000	.013333	.010266	....	....	
93,000	.021000	.007667	....	....	
94,000	.022333	.001333	....	....	
96,000	.023833	.001500	....	....	
100,000	.029333	.005500	....	....	
105,000	.038333	.009000	....	....	
110,000	.0500	.0117	....	....	
115,000	.0700	.0200	....	....	
120,000	.1133	.0433	....	....	
121,200	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	121,200
Elastic limit per square inch of original section	do...	91,000
Elongation per inch after rupture	inch..	.1633
Elongation per inch under strain at elastic limit	do...	.003067
Reduction in external diameter at point of rupture	do...	.096
Position of rupture		″.75 from neck
Character of broken surface		silky, cup-shaped
Elongation of inch sections		″.10, ″.13, ″.26*

No. 7391.

Marks, M 3 C.
Exterior diameter, ″.466.
Interior diameter, ″.300.
Sectional area, .10 square inch.
Gauged length, 3″.
From middle of length of finished barrel.
Rolled, and cooled in air.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.001000	.000367	....	....	
40,000	.001333	.000333	....	....	
50,000	.001667	.000334	....	....	
60,000	.002000	.000333	0.	0.	
70,000	.002333	.000333	....	....	
80,000	.002667	.000334	....	....	
86,000	.002867	.000200	....	....	Elastic limit.
87,000	.025833	.002966	....	....	
88,000	.026667	.000834	....	....	
90,000	.029667	.003000	....	....	
95,000	.036667	.007000	....	....	
100,000	.047667	.011000	....	....	
105,000	.0700	.0223	....	....	
110,000	.0867	.0167	....	....	
112,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section..........pounds..	112,500
Elastic limit per square inch of original section..........do....	86,000
Elongation per inch after rupture..........inch..	.1867
Elongation per inch under strain at elastic limit..........do....	.002867
Reduction in diameter at point of rupture..........do....	.106
Position of rupture..........	1″.3 from neck
Character of broken surface..........	silky, cup-shaped
Elongation of inch sections..........	″.18, ″.27*, ″.11

No. 7392.

Marks, M 3 C.
Exterior diameter, ″.466.
Interior diameter, ″.300.
Sectional area, .10 square inch.
Gauged length, 3″.
From middle of length of finished barrel.
Rolled, and cooled in air.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000667	.000367	....	....	
30,000	.001033	.000366	....	....	
40,000	.001367	.000334	....	....	
50,000	.001700	.000333	....	....	
60,000	.002067	.000367	0.	0.	
70,000	.002400	.000333	....	....	
80,000	.002800	.000400	....	....	
85,000	.003000	.000200	....	....	
89,000	.003133	.000133	....	....	Elastic limit.
90,000	.036000	.032867	....	....	
91,000	.037167	.001167	....	....	
92,000	.038667	.001500	....	....	
95,000	.0467	.0080	....	....	
100,000	.0600	.0133	....	....	
105,000	.0900	.0300	....	....	
108,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ......pounds..	108,600
Elastic limit per square inch of original section......do....	89,000
Elongation per inch after rupture......inch..	.2033
Elongation per inch under strain at elastic limit......do....	.003133
Reduction in external diameter at point of rupture......do....	.116
Position of rupture......	1″.4 from neck
Character of broken surface......	silky, cup-shaped
Elongation of inch sections......	″.14, ″.30 *, ″.17

TABULATION OF TENSION SPECIMENS FROM RIFLE BARRELS, .30 CALIBER.

No. of test.	Marks.	Description.	Treatment.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 1 inch or 3 inches.	Appearance of fracture.	Elongation of inch sections.
				Sq. inch.	*Pounds.*	*Pounds.*	*Per cent.*		*Inch.*
7399	M 3 D	Specimen from the bar		0.25	75,000	118,880	23.0	Fine granular, 60 per cent; silky, 40 per cent.	.23
7400	M 3 D	do		.25	59,000	97,600	20.0	Granular, 50 per cent; silky, 50 per cent.	.20
7401	M 3 D	do		.25	73,000	118,400	18.0	Granular, 80 per cent; silky, 20 per cent.	.18
7393	M 3 A	Butt of finished barrel	Rolled, and annealed as usual	.25	68,000	108,160	26.0	Silky, cup-shaped	.26
7394	M 3 A	do	do	.25	68,000	107,280	18.0	Fine granular, 80 per cent; silky, 20 per cent.	.18
7395	M 3 B	do	Rolled, and annealed at residual heat	.25	84,000	118,800	18.0	Fine granular	.18
7396	M 3 B	do	do	.25	80,000	117,680	15.0	do	.15
7397	M 3 C	do	Rolled, and cooled in the air	.25	56,000	92,480	30.0	Silky, cup-shaped	.30
7398	M 3 C	do	do	.25	76,000	113,200	21.0	Fine granular, 40 per cent; silky, 60 per cent.	.21
7387	M 3 A	From middle of length of finished barrel.	Rolled, and annealed as usual	.10	87,000	106,200	20.0	Silky, cup-shaped	.13, .32*, .15
7388	M 3 A	do	do	.10	61,000	90,200	22.0	do	.26*, .26*, .11
7389	M 3 B	do	Rolled, and annealed at residual heat	.10	93,000	117,400	18.0	do	.27*, .16, .11
7390	M 3 B	do	do	.10	91,000	121,200	16.3	do	.10, .13, .26*
7391	M 3 C	do	Rolled, and cooled in the air	.10	86,000	112,500	18.7	do	.18, .27*, .11
7392	M 3 C	do	do	.10	89,000	108,600	20.3	do	.14, .30*, .17

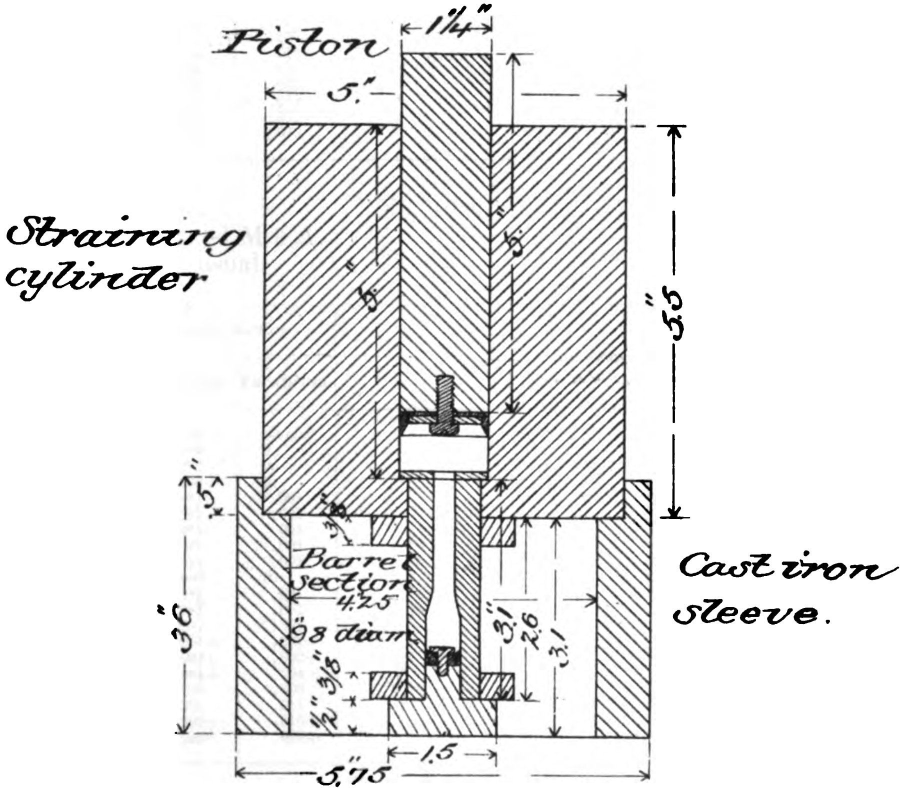
HYDROSTATIC TESTS

OF

SECTIONS FROM BREECH OF .30 CALIBER RIFLE BARRELS.

Rifle Barrels. .30 caliber.

Attachment for straining breech sections with hydrostatic pressure.



THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

The finished barrels from which these sections were taken for hydrostatic tests by interior pressures in the powder chambers were forwarded from Springfield Armory.

Tensile tests of the material next precede these results.

No. 10290.

Section marked M 3 A.
Annealed as usual.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inches.*	*Inch.*	
16,300	0.980+	0.	
24,450	.980+	0.	
28,520	.982	.002−	
32,600	.986	.006−	
34,640	.988	.008−	
36,670	.990	.010−	
38,710	.991+	.011	
40,750	.994−	.014−	
16,300	.993	.013−	
42,790	.997	.017−	
44,820	.999	.019−	
48,900	1.005	.025	
52,970	1.013	.033	
57,050	1.032	.052	
61,120	1.057	.077	
16,300	1.056	.076	

No. 10291.

Section marked M 3 A.
Annealed as usual.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980+	0.	
28,520	.980+	0.	
32,600	.981	.001	
34,640	.981	.001	
36,670	.981	.001	
38,710	.981	.001	
40,750	.981	.001	
16,300	.980	0.	
42,790	.981	.001	
44,820	.981	.001	
46,860	.981	.001	
48,900	.981+	.001+	
50,940	.982+	.002+	
52,970	.984+	.004+	
55,010	.989	.009	
57,050	.991	.011	
61,120	.996+	.016+	
16,300	.995+	.015+	

No. 10292.

Section marked M 3 A.
Annealed as usual.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inches.*	*Inch.*	
16,300	0.979+	0.	
24,450	.979+	0.	
28,520	.980	.001	
32,600	.986+	.007	
34,640	.988	.009	
36,670	.990	.011	
38,710	.992	.013	
40,750	.994	.015	
16,300	.993	.014	
42,790	.996+	.017	
44,820	.998+	.019	
48,900	1.005+	.026	
52,970	1.015	.036	
57,050	1.029	.050	
58,680	....	....	Momentarily reached.
0	1.038	.059	

No. 10293.

Section marked M 3 A.
Annealed as usual.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inches.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980+	0. +	
32,600	.984+	.004	
34,640	.986+	.006	
36,670	.988	.008	
38,710	.991	.011	
40,750	.993	.013	
16,300	.992	.012	
42,790	.995	.015	
44,820	.997	.017	
48,900	1.006+	.026	
52,970	1.013	.033	
57,050	1.029	.049	
61,120	....	....	Momentarily reached.
16,300	1.052	.072	

No. 10294.

Section marked M 3 A.
Annealed as usual.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980	0.	
32,600	.980+	0. +	
34,640	.980+	0. +	
36,670	.980+	0. +	
38,710	.980+	0. +	
40,750	.980+	0. +	
16,300	.980	0.	
42,790	.980+	0. +	
44,820	.981	.001	
46,860	.981+	.001+	
48,900	.983+	.003+	
50,940	.986	.006	
52,970	.988	.008	
57,050	.993+	.013	
61,120	.998	.018	
16,300	.997	.017	

No. 10295.

Section marked M 3 B.
Annealed by residual heat.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inches.*	*Inch.*	
16,300	0.980½	0.	
24,450	.980½	0.	
28,520	.980½	0.	
32,600	.981	.000½	
34,640	.981	.000½	
36,670	.981	.000½	
38,710	.981	.000½	
40,750	.981	.000½	
16,300	.980½	.0	
42,790	.981	.000½	
44,820	.981+	.000½+	
46,860	.982−	.001½	
48,900	.983	.002½	
50,940	.988	.007½	
52,970	.991½	.011	
57,050	.997+	.017−	
61,120	1.002+	.022−	
16,300	1.001+	.021−	

No. 10296.

Section marked M 3 B.
Annealed by residual heat.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16, 300	0. 980	0.	
24, 450	. 980	0.	
28, 520	. 980	0.	
32, 600	. 980+	0. +	
34, 640	. 980+	0. +	
36, 670	. 980+	0. +	
38, 710	. 980+	0. +	
40, 750	. 980+	0. +	
16, 300	. 980	0.	
42, 790	. 980+	0. +	
44, 820	. 981	. 001	
46, 860	. 981	. 001	
48, 900	. 981	. 001	
50, 940	. 981	. 001	
52, 970	. 981+	. 001+	
55, 010	. 982+	. 002+	
57, 050	. 937+	. 007+	
59, 090	. 991	. 011	
61, 120	. 995+	. 015+	
16, 300	. 994+	. 014+	

No. 10297.

Section marked M 3 B.
Annealed by residual heat.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16, 300	0. 980	0.	
24, 450	. 980	0.	
28, 520	. 980+	0. +	
32, 600	. 980+	0. +	
34, 640	. 980+	0. +	
36, 670	. 980+	0. +	
38, 710	. 980+	0. +	
40, 750	. 980+	0. +	
42, 790	. 981	. 001	
44, 820	. 981	. 001	
46, 860	. 981	. 001	
48, 900	. 981+	. 001+	
50, 940	. 982	. 002	
52, 970	. 985	. 005	
55, 010	. 988+	. 008+	
57, 050	. 992	. 012	
59, 090	. 994+	. 014+	
61, 120	. 997+	. 017+	
16, 300	. 996+	. 016+	

No. 10298.

Section marked M 3 B.
Annealed by residual heat.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inches.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980	0.	
32,600	.980	0.	
34,640	.981	.001	
36,670	.981	.001	
38,710	.981	.001	
40,750	.981	.001	
42,790	.981	.001	
44,820	.981	.001	
46,860	.981	.001	
48,900	.981+	.001+	
50,940	.986+	.006+	
52,970	.989	.009	
57,050	.994	.014	
61,120	1.001	.021	
16,300	.999+	.019+	

No. 10299.

Section marked M 3 B.
Annealed by residual heat.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980	0.	
32,600	.980+	0.+	
34,640	.980+	0.+	
36,670	.980+	0.+	
38,710	.980+	0.+	
40,750	.980+	0.+	
42,790	.981	.001	
44,820	.981	.001	
46,860	.981	.001	
48,900	.981+	.001+	
50,940	.982+	.002+	
52,970	.986+	.006+	
55,010	.989+	.009+	
57,050	.992	.012	
59,090	.994+	.014+	
61,120	.998+	.018+	
16,300	.997	.017	

No. 10300.

Section marked M 3 C.
Cooled in air.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980	0.	
32,600	.980+	0. +	
34,640	.980+	0. +	
36,670	.980+	0. +	
38,710	.980+	0. +	
40,750	.980+	0. +	
42,790	.980+	0. +	
44,820	.981	.001	
46,860	.981	.001	
48,900	.981	.001	
50,940	.981	.001	
52,970	.982	.002	
55,010	.990	.010	
57,050	.998	.018	
59,090	.998+	.018+	
61,120	.999	.019	
16,300	.997+	.017+	
61,120	.999	.019	
16,300	.997+	.017+	

No. 10301.

Section marked M 3 C.
Cooled in air.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980	0.	
32,600	.980	0.	
34,640	.980+	0. +	
36,670	.980+	0. +	
38,710	.980+	0. +	
40,750	.980+	0. +	
42,790	.980+	0. +	
44,820	.980+	0. +	
46,860	.981	.001	
48,900	.981	.001	
50,940	.981+	.001+	
52,970	.982+	.002+	
55,010	.984	.004	
57,050	.990	.010	
59,090	.992+	.012+	
61,120	.995+	.015+	
16,300	.993+	.013+	

No. 10302.

Section marked M 3 C.
Cooled in air.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980	0.	
32,600	.980¼	.000¼	
34,640	.980¼	.000¼	
36,670	.980¼	.000¼	
38,710	.980¼	.000¼	
40,750	.980¼	.000¼	
42,790	.981	.001	
44,820	.981	.001	
46,860	.981	.001	
48,900	.981	.001	
50,940	.982	.002	
52,970	.987	.007	
55,010	.991	.011	
57,050	.992+	.012+	
59,090	.994+	.014+	
61,120	.997	.017	
16,300	.996	.016	

No. 10303.

Section marked M 3 C.
Cooled in air.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980+	0. +	
32,600	.980+	0. +	
34,640	.980+	0. +	
36,670	.980+	0. +	
38,710	.980+	0. +	
40,750	.981	.001	
42,790	.981	.001	
44,820	.981	.001	
46,860	.981	.001	
48,900	.981+	.001+	
50,940	.982+	.002+	
52,970	.989	.009	
55,010	.991	.011	
57,050	.993	.013	
59,090	.995	.015	
61,120	.997+	.017+	
16,300	.996+	.016+	

No. 10304.

Section marked M 3 C.
Cooled in air.

Pressure per square inch.	Barrel section.		Remarks.
	Diameter.	Expansion.	
Pounds.	*Inch.*	*Inch.*	
16,300	0.980	0.	
24,450	.980	0.	
28,520	.980	0.	
32,600	.980	0.	
34,640	.980	0.	
36,670	.980	0.	
38,710	.980	0.	
40,750	.980	0.	
42,790	.980	0.	
44,820	.980	0.	
46,860	.980	0.	
48,900	.980½	.000½	
50,940	.981	.001	
52,970	.984	.004	
55,010	.991+	.011+	
57,050	.995	.015	
59,090	.996+	.016+	
61,120	.998	.018	
16,300	.997	.017	

STEEL FOR GUN MOUNTS.

SPECIMENS FROM PIVOT SOCKETS, PIVOT YOKES, INNER BASES, OUTER BASES, AND CARRIER RINGS FOR 6-POUNDER AND 15-POUNDER MOUNTS.

CARRIER RINGS, 6-POUNDER GUNS.

STEEL FORGINGS.

No. 7317.

Marks, $^{\text{1.C R}}_{\text{6}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00020	.00005			
20,000	.00060	.00040			
30,000	.00095	.00035			
40,000	.00130	.00035			
45,000	.00150	.00020			
47,000	.00155	.00005			
48,000	.00165	.00010			Elastic limit.
49,000	.00235	.00070			
50,000	.00270	.00035			
51,000	.00320	.00050			
52,000	.00380	.00060			
53,000	.00425	.00045			
54,000	.00475	.00050			
106,000					Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	106,000
Elastic limit per square inch of original section .... do...	48,000
Elongation per inch after rupture .... inch..	.1500
Elongation per inch under strain at elastic limit .... do...	.00165
Reduction in diameter at point of rupture .... do...	.065
Reduction in area after rupture, per cent of original section	23.9
Position of rupture	″.54 from neck
Character of broken surface	fine granular, 80 per cent; dull silky, 20 per cent
Elongation of inch sections	″.19,* ″.11

No. 7318.

Marks, $^{2}\mathrm{C}_{6}^{\mathrm{R}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
30,000	.00095	.00035	....	....	
40,000	.00130	.00035	....	....	
50,000	.00165	.00035	....	....	
55,000	.00185	.00020	....	....	
59,000	.00205	.00020	....	....	Elastic limit.
60,000	.00240	.00035	....	....	
61,000	.00255	.00015	....	....	
62,000	.00295	.00040	....	....	
63,000	.00325	.00030	....	....	
64,000	.00365	.00040	....	....	
65,000	.00395	.00030	....	....	
66,000	.00445	.00050	....	....	
123,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,450
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1100
Elongation per inch under strain at elastic limit	do...	.00205
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.74 from neck
Character of broken surface		fine granular; silky spot at circumference
Elongation of inch sections		″.09 ″.13

No. 7319.

Marks, $^{3\,C\,R}_{\;\;6}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00065	.00035	....	....	
30,000	.00100	.00035	....	....	
40,000	.00140	.00040	....	....	
50,000	.00180	.00040	....	....	
51,000	.00185	.00005	....	....	
52,000	.00195	.00010	....	....	Elastic limit.
53,000	.00280	.00105	....	....	
54,000	.00315	.00035	....	....	
55,000	.00360	.00045	....	....	
56,000	.00400	.00040	....	....	
57,000	.00450	.00050	....	....	
58,000	.00500	.00050	....	....	
113,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength, per square inch of original section.....pounds..	118,500
Elastic limit, per square inch of original section.....do...	52,000
Elongation per inch after rupture.....inch..	.1350
Elongation per inch under strain at elastic limit.....do...	.00195
Reduction in diameter at point of rupture.....do...	.065
Reduction in area after rupture, per cent of original section.....	23.9
Position of rupture.....	1″.02 from neck
Character of broken surface.....:	fine granular, 85 per cent; silky, 15 per cent
Elongation of inch sections.....	″.15*, ″.12

No. 7373.

Marks, $^{15}\overset{\mathrm{C\,R}}{6}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00100	.00040	....	....	
37,000	.00135	.00035	....	....	Elastic limit.
38,000	.01035	.00900	....	....	
39,000	.01100	.00065	....	....	
40,000	.01200	.00100	....	....	
41,000	.01350	.00150	....	....	
42,000	.01460	.00110	....	....	
72,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,100
Elastic limit per square inch of original section	do...	37,000
Elongation per inch after rupture	inch..	.3350
Elongation per inch under strain at elastic limit	do...	.00135
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		51.9
Position of rupture		at the middle of the stem
Character of broken surface		fine silky
Elongation of inch sections		″.36*, ″.31

TABULATION OF STEEL SPECIMENS FROM 6-POUNDER AND 15-POUNDER GUN MOUNTS. (STEMS OF SPECIMENS, 2″ LONG.)

CARRIER RINGS OF 6-POUNDER GUNS, STEEL FORGINGS.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		″ ″
7317	$\overset{1\,\mathrm{C\,R}}{6}$	.505	.20	48,000	106,000	15.0	23.9	Fine granular 80 per cent, dull silky 20 per cent.	.19*, .11
7318	$\overset{2\,\mathrm{C\,R}}{6}$	.505	.20	59,000	123,450	11.0	16.9	Fine granular, silky spot at circumference.	.09, .13*
7319	$\overset{3\,\mathrm{C\,R}}{6}$	.505	.20	52,000	113,500	13.5	23.9	Fine granular 85 per cent, silky 15 per cent.	.15*, .12
7373	$\overset{15\,\mathrm{C\,R}}{6}$	.505	.20	37,000	72,100	33.5	51.9	Fine silky.	.36*, .31

PIVOT SOCKETS—15-POUNDER GUN MOUNTS.

STEEL CASTINGS.

No. 7224.

Marks, $\overset{A\ 92}{2\ P\ S\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
25,000	.00090	.00030	....	....	
27,000	.00100	.00010	....	....	Elastic limit.
28,000	.00170	.00070	....	....	
29,000	.00215	.00045	....	....	
30,000	.00285	.00070	....	....	
31,000	.00360	.00075	....	....	
32,000	.00440	.00080	....	....	
33,000	.00505	.00065	....	....	
73,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	73,500
Elastic limit per square inch of original section	do...	27,000
Elongation per inch after rupture	inch..	.1950
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1″.10 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.20*, ″.19

No. 7225.

Marks, $\overset{A\ 127}{2\ P\ S\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020	....	....	
20,000	.00065	.00030	....	....	
25,000	.00085	.00020	....	....	
27,000	.00095	.00010	....	....	
28,000	.00100	.00005	....	....	Elastic limit.
29,000	.00515	.00415	....	....	
30,000	.00575	.00060	....	....	
31,000	.00665	.00090	....	....	
32,000	.00745	.00080	....	....	
33,000	.00830	.00085	....	....	
72,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,500
Elastic limit per square inch of original section	do...	28,000
Elongation per inch after rupture	inch..	.2250
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″. from neck
Character of broken surface		granular 60 per cent, silky 40 per cent
Elongation of inch sections		″.21, ″.24*

No. 7230.

Marks, $\genfrac{}{}{0pt}{}{\text{A 137}}{\text{P S 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00005	.00005	0.	0.	
10,000	.00020	.00015	....	....	
20,000	.00050	.00030	....	....	
25,000	.00070	.00020	....	....	
29,000	.00095	.00025	....	....	Elastic limit.
30,000	.00100 .00600	.00005 .00500	....	....	
31,000	.00700	.00100	....	....	
32,000	.00800	.00100	....	....	
33,000	.00890	.00090	....	....	
34,000	.00990	.00100	....	....	
69,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 69,9
Elastic limit per square inch of original section ....do... 29,0
Elongation per inch after rupture ....inch.. .16
Elongation per inch under strain at elastic limit ....do... .0005
Reduction in diameter at point of rupture ....do... .04
Reduction in area after rupture, per cent of original section .... 16.
Position of rupture .... ".60 from ne
Character of broken surface .... granular, silky spot at circumferenc
Elongation of inch sections .... ".15, ".1

No. 7231.

Marks, $\genfrac{}{}{0pt}{}{\text{A 138}}{\text{P S 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
21,000	.00070	.00010	....	....	
22,000	.00085	.00015	....	....	Elastic limit.
23,000	.00160	.00075	....	....	
24,000	.00225	.00065	....	....	
25,000	.00340	.00115	....	....	
26,000	.00450	.00110	....	....	
27,000	.00550	.00100	....	....	
62,650	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 62,650
Elastic limit per square inch of original section ....do... 22,000
Elongation per inch after rupture ....inch.. .1000
Elongation per inch under strain at elastic limit ....do... .0008
Reduction in diameter at point of rupture ....do... .065
Reduction in area after rupture, per cent of original section 13.2
Position of rupture .... ".80 from neck
Character of broken surface .... granular, silvery luster, silky spot at circumference
Elongation of inch sections .... ".12*, ".06

No. 7232.

Marks, $\overset{A\ 140}{2\ P\ S\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2.

Applied loads per squarse inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	emarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00005	.00005	0.	0.	
10,000	.00020	.00015	....	....	
20,000	.00050	.00030	....	....	
25,000	.00070	.00020	....	....	
28,000	.00085	.00015	....	....	
29,000	.00095	.00010	....	....	Elastic limit.
30,000	.00775	.00680	....	....	
31,000	.00875	.00100	....	....	
32,000	.00965	.00090	....	....	
33,000	.01065	.00100	....	....	
34,000	.01175	.00110	....	....	
64,850	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,850
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.1050
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		132
Position of rupture		″.68 from neck
Character of broken surface		granular 80 per cent, silky 20 per cent
Elongation of inch sections		″.11*, ″.10

No. 7233.

Marks, $\overset{A\ 152}{P\ S\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00005	.00005	0.	0.	
10,000	.00020	.00015	....	....	
20,000	.00065	.00035	....	....	
30,000	.00100	.00045	....	....	
32,000	.00110	.00010	....	....	
33,000	.00115	.00005	....	....	Elastic limit.
34,000	.00985	.00870	....	....	
35,000	.01050	.00065	....	....	
36,000	.01150	.00100	....	....	
37,000	.01250	.00100	....	....	
38,000	.01375	.00125	....	....	
69,950	....	....	....	....	Tensile strength.

General-summary.

Tensile strength per square inch of original section	pounds..	69,950
Elastic limit per square inch of original section	do...	33,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		1″.10 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.15, ″.17*

No. 7234.

Marks, A 153 P S 15
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00075	.00045	....	....	Elastic limit.
21,000	.00095	.00020	....	....	
22,000	.00145	.00050	....	....	
23,000	.00235	.00090	....	....	
24,000	.00315	.00080	....	....	
25,000	.00400	.00085	....	....	
26,000	.00485	.00085	....	....	
58,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	58,400
Elastic limit per square inch of original section	do...	20,000
Elongation per inch after rupture	inch..	.0750
Elongation per inch under strain at elastic limit	do...	.00075
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		".55 from neck
Character of broken suface		granular, silvery luster, silky spot at circumference
Elongation of inch sections		".08*, ".07

No. 7235.

Marks, A 154 P S 15
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00070	.00040	....	....	
29,000	.00110	.00040	....	....	
30,000	.00115	.00005	....	....	Elastic limit
31,000	.00715	.00600	....	....	
32,000	.00775	.00060	....	....	
33,000	.00850	.00075	....	....	
34,000	.00950	.00100	....	....	
35,000	.01040	.00090	....	....	
71,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	71,000
Elastic limit per square inch of original section	do...	30,000
Elongation per inch after rupture	inch..	.1450
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".85 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".15*, ".14

No. 7274.

Marks, $\overset{\text{A 155}}{\text{P S 15}}$
Diameter ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
19,000	.00065	.00030			Elastic limit.
20,000	.00115	.00050			
21,000	.00165	.00050			
22,000	.00230	.00065			
23,000	.00340	.00110			
24,000	.00450	.00110			
58,550					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	58,550
Elastic limit per square inch of original section	do...	19,000
Elongation per inch after rupture	inch..	.1550
Elongation per inch under strain at elastic limit	do...	.00065
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".7 from neck
Character of broken surface		medium coarse granular, brilliant facets
Elongation of inch sections		".14, ".17*

No. 7236.

Marks, $\overset{\text{A 156}}{\text{P S 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00065	.00035			
25,000	.00080	.00015			
28,000	.00095	.00015			
29,000	.00100	.00005			
30,000	.00105	.00005			Elastic limit.
31,000	.00425	.00320			
32,000	.00750	.00325			
33,000	.00825	.00075			
34,000	.00900	.00075			
35,000	.01000	.00100			
70,950					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,950
Elastic limit per square inch of original section	do...	30,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do ..	.00105
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".30 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".15, ".17*

No. 7331.

Marks, $\frac{\text{A 158}}{\text{P S 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00065	.00035	....	....	
30,000	.00105	.00040	....	....	
32,000	.00110	.00005	....	....	
33,000	.00115	.00005	....	....	Elastic limit.
34,000	.00600	.00485	....	....	
35,000	.00700	.00100	....	....	
36,000	.00775	.00075	....	....	
37,000	.00890	.00115	....	....	
38,000	.00950	.00060	....	....	
76,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,900
Elastic limit per square inch of original section	do...	33,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".40 from neck
Character of broken surface		granular 80 per cent, silky 20 per cent
Elongation of inch sections		".13, ".17*

No. 7336.

Marks, $\frac{\text{A 159}}{\text{P S 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
19,000	.00070	.00040	....	....	Elastic limit.
20,000	.00085	.00015	....	....	
21,000	.00100	.00015	....	....	
22,000	.00110	.00010	....	....	
23,000	.00150	.00040	....	....	
24,000	.00225	.00075	....	....	
25,000	.00335	.00110	....	....	
26,000	.00460	.00125	....	....	
27,000	.00550	.00090	....	....	
28,000	.00640	.00090	....	....	
29,000	.00735	.00095	....	....	
30,000	.00860	.00125	....	....	
60,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	60,900
Elastic limit per square inch of original section	do...	19,000
Elongation per inch after rupture	inch..	.1060
Elongation per inch under strain at elastic limit	do...	.00070
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Position of rupture		".50 from neck
Character of broken surface		granular, silvery luster
Elongation of inch sections		".11*, ".10

No. 7337.

Marks, A 160 P S 15
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
15,000	.00045	.00015	....	....	
18,000	.00060	.00015	....	....	
19,000	.00065	.00005	....	....	Elastic limit.
20,000	.00080	.00015	....	....	
21,000	.00095	.00015	....	....	
22,000	.00140	.00045	....	....	
23,000	.00265	.00125	....	....	
24,000	.00350	.00085	....	....	
25,000	.00450	.00100	....	....	
26,000	.00540	.00090	....	....	
27,000	.00625	.00085	....	....	
59,950	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	59,950
Elastic limit per square inch of original section	do...	19,000
Elongation per inch after rupture	inch..	.0900
Elongation per inch under strain at elastic limit	do...	.00065
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		".35 from neck
Character of broken surface		granular, silvery luster
Elongation of inch sections		".10*, ".08

No. 7338.

Marks, A 161. P S 15.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive Elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00075	.00045	....	....	
23,000	.00095	.00020	....	....	
24,000	.00100	.00005	....	....	Elastic limit.
25,000	.00140	.00040	....	....	
26,000	.00450	.00810	....	....	
27,000	.00525	.00075	....	....	
28,000	.00575	.00050	....	....	
29,000	.00680	.00105	....	....	
30,000	.00775	.00095	....	....	
56,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	56,500
Elastic limit per square inch of original section	do...	24,000
Elongation per inch after rupture	inch..	.0500
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		".60 from neck
Character of broken surface		granular 60 per cent, dull silky 40 per cent
Elongation of inch sections		.04, .06*

No. 7339.

Marks, $\frac{\text{A 165}}{\text{P S 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00070	.00040	....	....	
21,000	.00080	.00010	....	....	
22,000	.00085	.00005	....	....	
23,000	.00095	.00010	....	....	Elastic limit.
24,000	.00140	.00045	....	....	
25,000	.00175	.00035	....	....	
26,000	.00250	.00075	....	....	
27,000	.00340	.00090	....	....	
28,000	.00460	.00120	....	....	
29,000	.00510	.00050	....	....	
30,000	.00640	.00130	....	....	
65,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	66,500
Elastic limit per square inch of original section	do...	23,000
Elongation per inch after rupture	inch..	.1750
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		".90 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".18*, ".17

No. 7346.

Marks, $\frac{\text{A 125}}{\text{2 P S 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00065	.00035	....	....	
29,000	.00100	.00035	....	....	Elastic limit.
30,000	.00150	.00050	....	....	
31,000	.01250	.01100	....	....	
32,000	.01355	.00105	....	....	
33,000	.01500	.00145	....	....	
34,000	.01650	.00150	....	....	
61,850	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	61,850
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.075
Reduction in area after rupture, per cent of original section		27.4
Position of rupture		".50 from neck
Character of broken surface		dull gray, amorphous
Elongation of inch sections		".17, ".25*

No. 7347.

Marks, $\overset{\text{A 150}}{\text{2 P S 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00045	....	....	
29,000	.00120	.00040	....	....	Elastic limit.
30,000	.00145	.00025	....	....	
31,000	.00170	.00025	....	....	
32,000	.00850	.00680	....	....	
33,000	.01000	.00150	....	....	
34,000	.01100	.00100	....	....	
70,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,100
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.2150
Elongation per inch under strain at elastic limit	do...	.00120
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		″.70 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.19, ″.24*

PIVOT SOCKETS, 15-POUNDER GUN MOUNTS, STEEL CASTINGS.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	
		Inches.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		"	"
7224	A 92 2 P S 15	.505	.20	27,000	73,500	19.5	20.5	Granular 85 per cent, silky 15 per cent	.20*,	.19
7225	A 127 2 P S 15	.505	.20	28,000	72,500	22.5	23.9	Granular 60 per cent, silky 40 per cent	.21,	.24*
7230	A 137 P S 15	.505	.20	29,000	69,900	16.5	16.9	Granular, silky spot at circumference	.15,	.18*
7331	A 138 P S 15	.505	.20	22,000	62,650	10.0	13.2	Granular, silvery luster, silky spot at circumference	.12*,	.08
7232	A 140 2 P S 15	.505	.20	29,000	64,850	10.5	13.2	Granular 80 per cent, silky 20 per cent	.11*,	.10
7233	A 152 P S 15	.505	.20	33,000	69,950	16.0	16.9	Granular, silky spot at circumference	.15,	.17*
7234	A 153 P S 15	.505	.20	20,000	58,400	7.5	9.5	Granular, silvery luster, silky spot at circumference	.08*,	.07
7235	A 154 P S 15	.505	.20	30,000	71,000	14.5	16.9	Granular, silky spot at circumference	.15*,	.14
7274	A 155 P S 15	.505	.20	19,000	58,550	15.5	16.9	Medium, coarse, granular; brilliant facets	.14,	.17*
7236	A 156 P S 15	.505	.20	30,000	70,950	16.0	16.9	Granular, silk spot at circumference	.15,	.17*
7331	A 158 P S 15	.505	.20	33,000	76,900	15.0	16.9	Granular 80 per cent, silky 20 per cent	.13,	.17*
7336	A 159 P S 15	.505	.20	19,000	60,900	10.5	13.2	Granular, silvery luster	.11*,	.10
7337	A 160 P S 15	.505	.20	19,000	59,950	9.0	9.5	....do	.10*,	.08
7338	A 161 P S 15	.505	.20	24,000	56,500	5.0	9.5	Granular 60 per cent, dull silky 40 per cent	.04,	.06*
7339	A 165 P S 15	.505	.20	23,000	66,500	17.5	20.5	Granular, silky spot at circumference	.18*,	.17
7346	A 125 2 P S 15	.505	.20	29,000	61,850	21.0	27.4	Dull gray, amorphous	.17,	.25*
7347	A 150 2 P S 15	.505	.20	29,000	70,100	21.5	23.9	Granular, silky spot at circumference	.19,	.24*

PIVOT YOKES—15-POUNDER GUN MOUNTS.

STEEL CASTINGS.

No. 7262.

Marks, $\overset{\text{S 75}}{\text{3 P Y 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00070	.00035	....	....	
29,000	.00100	.00030	....	....	Elastic limit.
30,000	.00120	.00020	....	....	
31,000	.00145	.00025	....	....	
32,000	.00800	.00655	....	....	
33,000	.00875	.00075	....	....	
34,000	.00950	.00075	....	....	
72,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,600
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.1750
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1".05 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".17, ".18*

No. 7212.

Marks, $\overset{\text{S 82}}{\text{P Y 12}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00065	.00035	....	....	
27,000	.00095	.00030	....	....	Elastic limit.
28,000	.00240	.00145	....	....	
29,000	.00325	.00085	....	....	
30,000	.00500	.00175	....	....	
31,000	.00700	.00200	....	....	
32,000	.00825	.00125	....	....	
69,200	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	69,200
Elastic limit per square inch of original section	do...	27,000
Elongation per inch after rupture	inch..	.1950
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		".8 from neck
Character of broken surface		granular 60 per cent, silky 40 per cent
Elongation of inch sections		".17, ".22*

No. 7226.

Marks, $\overset{\text{S 84}}{\text{2 P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
33,000	.00110	.00010	....	....	Elastic limit.
34,000	.01060	.00950	....	....	
35,000	.01090	.00030	....	....	
36,000	.01160	.00070	....	....	
37,000	.01250	.00090	....	....	
38,000	.01360	.00110	....	....	
49,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................pounds.. 49,900
Elastic limit per square inch of original section....................do... 33,000
Elongation per inch after rupture....................inch.. .065
Elongation per inch under strain at elastic limit....................do... .0011
Reduction in diameter at point of rupture....................do... .03
Reduction in area after rupture, per cent of original section.................... 5.
Position of rupture.................... ″.40 from neck
Character of broken surface.................... silky, trace of granulation
Elongation of inch sections.................... ″.08*, ″.05

No. 7263.

Marks, $\overset{\text{S 88}}{\text{2 P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00070	.00035	....	....	
30,000	.00115	.00045	....	....	
33,000	.00135	.00020	....	....	Elastic limit.
34,000	.00750	.00615	....	....	
35,000	.00975	.00225	....	....	
36,000	.01050	.00075	....	....	
37,000	.01125	.00075	....	....	
38,000	.01225	.00100	....	....	
75,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................pounds.. 75,900
Elastic limit per square inch of original section....................do... 33,000
Elongation per inch after rupture....................inch.. .2100
Elongation per inch under strain at elastic limit....................do... .0013
Reduction in diameter at point of rupture....................do... .05
Reduction in area after rupture, per cent of original section.................... 23.9
Position of rupture.................... 1″ from neck
Character of broken surface.................... granular, silky spot at circumference
Elongation of inch sections.................... ″.23*, ″.19

No. 7264.

Marks, $\overset{S\ 90}{2\ P\ Y\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
20,000	.00080	.00045			
26,000	.00130	.00050			Elastic limit.
27,000	.00195	.00065			
28,000	.00265	.00070			
29,000	.00395	.00130			
30,000	.00425	.00030			
31,000	.00530	.00105			
68,900					Tensile strength.

General summary.

Tensile strength per square inch of original section......pounds..	68,900
Elastic limit per square inch of original section......do...	26,000
Elongation per inch after rupture......inch..	.2350
Elongation per inch under strain at elastic limit......do...	.00130
Reduction in diameter at point of rupture......do...	.085
Reduction in area after rupture, per cent of original section......	30.7
Position of rupture......	″.6 from neck
Character of broken surface......	dull silky
Elongation of inch sections......	″.28*, ″.19

No. 7271.

Marks, $\overset{S\ 91}{2\ P\ Y\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
20,000	.00065	.00030			
30,000	.00100	.00035			
34,000	.00125	.00025			Elastic limit.
35,000	.00900	.00775			
36,000	.00950	.00050			
37,000	.01000	.00050			
38,000	.01100	.00100			
39,000	.01215	.00115			
74,400					Tensile strength.

General summary.

Tensile strength per square inch of original section......pounds..	74,400
Elastic limit per square inch of original section......do...	34,000
Elongation per inch after rupture......inch..	.1750
Elongation per inch under strain at elastic limit......do...	.00125
Reduction in diameter at point of rupture......do...	.055
Reduction in area after rupture, per cent of original section......	20.5
Position of rupture......	″.85 from neck
Character of broken surface......	granular, silky spot at circumference
Elongation of inch sections......	″.16, ″.19*

No. 7249.

Marks, $\overset{\text{S 92}}{\text{P Y 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
25,000	.00075	.00015	....	....	
28,000	.00090	.00015	....	....	
29,000	.00095	.00005	....	....	Elastic limit.
30,000	.00325	.00230	....	....	
31,000	.00500	.00175	....	....	
32,000	.00575	.00075	....	....	
33,000	.00650	.00075	....	....	
34,000	.00725	.00075	....	....	
70,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds..	70,900
Elastic limit per square inch of original section.....do...	29,000
Elongation per inch after rupture.....inch..	.065
Elongation per inch under strain at elastic limit.....do...	.00095
Reduction in diameter at point of rupture.....do...	.02
Reduction in area after rupture, per cent of original section.....	9.5
Position of rupture.....	".90 from neck
Character of broken surface.....	granular, silky spot at circumference
Elongation of inch sections.....	".06, ".07

No. 7265.

Marks, $\overset{\text{S 93}}{\text{2 P Y 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00070	.00035	....	....	
29,000	.00100	.00030	....	....	Elastic limit.
30,000	.00130	.00030	....	....	
31,000	.00850	.00720	....	....	
32,000	.00915	.00065	....	....	
33,000	.01000	.00085	....	....	
34,000	.01075	.00075	....	....	
69,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds..	69,500
Elastic limit per square inch of original section.....do...	29,000
Elongation per inch after rupture.....inch..	.1600
Elongation per inch under strain at elastic limit.....do...	.00100
Reduction in diameter at point of rupture.....do...	.055
Reduction in area after rupture, per cent of original section.....	20.5
Position of rupture.....	".65 from neck
Character of broken surface.....	granular 60 per cent, dull amorphous 40 per cent
Elongation of inch sections.....	".14, ".18

No. 7272.

Marks, $\overset{S\ 94}{2\ P\ Y\ 15}$.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	....	....	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
35,000	.00120	.00020	....	....	Elastic limit.
36,000	.00910	.00790	....	....	
37,000	.01000	.00090	....	....	
38,000	.01040	.00040	....	....	
39,000	.01135	.00095	....	....	
40,000	.01240	.00105	....	....	
75,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	75,500
Elastic limit per square inch of original section	do...	35,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00120
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.35 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.16*, ″.14

No. 7284.

Marks, $\overset{S\ 95}{P\ Y\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
29,000	.00100	.00035	....	....	Elastic limit.
30,000	.00150	.00050	....	....	
31,000	.00500	.00350	....	....	
32,000	.00600	.00100	....	....	
33,000	.00680	.00080	....	....	
34,000	.00750	.00070	....	....	
71,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	71,100
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.0650
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.015
Reduction in area after rupture, per cent of original section		5.7
Position of rupture		″.65 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.06, ″.07*

No. 7227.

Marks, $\overset{S\ 96}{P\ Y\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00070	.00040			
23,000	.00085	.00015			
25,000	.00100	.00015			Elastic limit.
26,000	.00170	.00070			
27,000	.00250	.00080			
28,000	.00350	.00100			
29,000	.00465	.00115			
30,000	.00565	.00100			
62,850					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	62,850
Elastic limit per square inch of original section	do...	25,000
Elongation per inch after rupture	inch..	.1400
Elongation per inch under strain at elastic limit	do...	.0010
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		1". from neck
Character of broken surface		granular, silvery luster, silky spot at circumference
Elongation of inch sections		".14, ".14*

No. 7266.

Marks, $\overset{S\ 96}{2\ P\ Y\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00040	.00025			
20,000	.00080	.00040			
29,000	.00105	.00025			Elastic limit.
30,000	.00135	.00030			
31,000	.00160	.00025			
32,000	.00180	.00020			
33,000	.00225	.00045			
34,000	.00775	.00550			
77,000					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	77,000
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.1850
Elongation per inch under strain at elastic limit	do...	.00105
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1" from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".20*, ".17

No. 7250.

Marks, $\overset{\text{S 97}}{\text{P Y 15}}$

Diameter, ″.505.

Sectional area, .20 square inch.

Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00065	.00035	....	....	
25,000	.00095	.00030	....	....	
26,000	.00100	.00005	....	....	
27,000	.00105	.00005	....	....	Elastic limit.
28,000	.00810	.00705	....	....	
29,000	.00860	.00050	....	....	
30,000	.00935	.00075	....	....	
31,000	.01025	.00090	....	....	
32,000	.01140	.00115	....	....	
64,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,000
Elastic limit per square inch of original section	do...	27,000
Elongation per inch after rupture	inch..	.2250
Elongation per inch under strain at elastic limit	do...	.00105
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″ from neck
Character of broken surface		granular 80 per cent, silky 20 per cent
Elongation of inch sections		″.20, ″.25*

No. 7228.

Marks, $\overset{\text{S 100}}{\text{P Y 15}}$

Diameter, ″.505.

Sectional area, .20 square inch.

Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	.0	Initial load.
5,000	.00005	.00005	0.	.0	
10,000	.00015	.00010	....	....	
20,000	.00050	.00035	....	....	
30,000	.00085	.00035	....	....	
31,000	.00090	.00005	....	....	Elastic limit.
32,000	.00680	.00590	....	....	
83,000	.00750	.00070	....	....	
34,000	.00815	.00065	....	....	
35,000	.00905	.00090	....	....	
36,000	.01000	.00095	....	....	
69,700	....	....	....	....	Tensile strength.

General summary.

Textile strength per square inch of original section	pounds..	69,700
Elastic limit per square inch of original section	do...	31,000
Elongation per inch after rupture	inch..	.1000
Elongation per inch under strain at elastic limit	do...	.00090
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Position of rupture		″.35 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.11*, ″.09

No. 7267.

Marks, $\overset{\text{S 100}}{\text{2 P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015			
20,000	.00060	.00035			
30,000	.00100	.00040			
35,000	.00130	.00030			Elastic limit.
36,000	.01050	.00920			
37,000	.01110	.00060			
38,000	.01175	.00065			
39,000	.01265	.00090			
40,000	.01350	.00085			
73,700					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	73,700
Elastic limit per square inch of original section	do...	35,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00130
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.9 from neck
Character of broken surface		granular 80 per cent, silky 20 per cent
Elongation of inch sections		″.17, ″.19

No. 7229.

Marks, $\overset{\text{S 101}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020			
20,000	.00070	.00035			
30,000	.00115	.00045			
32,000	.00125	.00010			
33,000	.00135	.00010			Elastic limit.
34,000	.00840	.00705			
35,000	.00910	.00070			
36,000	.01000	.00090			
37,000	.01095	.00095			
38,000	.01190	.00095			
72,500					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,500
Elastic limit per square inch of original section	do...	33,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.00135
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.90 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.17, ″.23

No. 7251.

Marks, $\frac{\text{S }102}{\text{P Y }15}$

Diameter, ″.505.

Sectional area, .20 square inch.

Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00070	.00040	....	....	
25,000	.00095	.00025	....	....	
26,000	.00105	.00010	....	....	Elastic limit.
27,000	.00150	.00045	....	....	
28,000	.00375	.00225	....	....	
29,000	.00550	.00175	....	....	
30,000	.00645	.00095	....	....	
31,000	.00725	.00080	....	....	
68,700	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,700
Elastic limit per square inch of original section	do...	26,000
Elongation per inch after rupture	inch..	.1350
Elongation per inch under strain at elastic limit	do...	.00105
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″1.05 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.13*, ″.14

No. 7252.

Marks, $\frac{\text{S }106}{\text{P Y }15}$

Diameter, ″.505.

Sectional area, .20 square inch.

Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	
5,000	.00010	.00010	0.	0.	Initial load.
10,000	.00025	.00015	....	....	
20,000	.00065	.00040	....	....	
25,000	.00090	.00025	....	....	
28,000	.00105	.00015	....	....	
29,000	.00110	.00005	....	....	
30,000	.00120	.00010	....	....	Elastic limit.
31,000	.00650	.00530	....	....	
32,000	.00730	.00080	....	....	
33,000	.00810	.00080	....	....	
34,000	.00875	.00065	....	....	
35,000	.00960	.00085	....	....	
68,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,450
Elastic limit per square inch of original section	do...	30,000
Elongation per inch after rupture	inch..	.0950
Elongation per inch under strain at elastic limit	do...	.00120
Position of rupture		at the neck
Character of broken surface		granular 85 per cent, silky 15 per cent; silky section has blowhole ″.10 diameter
Elongation of inch sections		″.09, ″.10

No. 7268.

Marks, $\frac{\text{S 107}}{\text{P Y 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
20,000	.00070	.00035			
24,000	.00095	.00025			Elastic limit.
25,000	.00140	.00045			
26,000	.00200	.00060			
27,000	.00250	.00050			
28,000	.00325	.00075			
29,000	.00410	.00085			
66,900					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	66,900
Elastic limit per square inch of original section	do...	24,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".4 from neck
Character of broken surface		granular, brilliant facets
Elongation of inch sections		".13, ".17*

No. 7255.

Marks, $\frac{\text{S 108}}{\text{P Y 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00065	.00035			Elastic limit.
21,000	.00100	.00035			
22,000	.00145	.00045			
23,000	.00215	.00070			
24,000	.00310	.00095			
25,000	.00440	.00130			
62,400					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	62,400
Elastic limit per square inch of original section	do...	20,000
Elongation per inch after rupture	inch..	.1850
Elongation per inch under strain at elastic limit	do...	.00065
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		".8 from neck
Character of broken surface		granular, brilliant facets
Elongation of inch sections		".19*, ".18

No. 7256

Marks, $\overset{S\ 109}{PY\ 15}$

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00085	.00025	....	....	
20,000	.00060	.00025	....	....	
25,000	.00085	.00025	....	....	Elastic limit.
26,000	.00125	.00040	....	....	
27,000	.00350	.00225	....	....	
28,000	.00525	.00175	....	....	
29,000	.00625	.00100	....	....	
30,000	.00700	.00075	....	....	
64,750	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,750
Elastic limit per square inch of original section	do...	25,000
Elongation per inch after rupture	inch..	.0800
Elongation per inch under strain at elastic limit	do...	.00085
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		".10 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".09*, ".07

No. 7276.

Marks, $\overset{S\ 110}{PY\ 15}$

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00070	.00035	....	....	
29,000	.00100	.00030	....	....	Elastic limit.
30,000	.00125	.00025	....	....	
31,000	.00300	.00175	....	....	
32,000	.00710	.00410	....	....	
33,000	.00775	.00065	....	....	
34,000	.00890	.00115	....	....	
64,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,500
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.0850
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Position of rupture		".65 from neck
Character of broken surface		dull silky, oblique. Contains a sand spot ".10 diameter
Elongation of inch sections		".06, ".11*

No. 7277.

Marks, $\overset{\text{S 111}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00055	.00025			
30,000	.00095	.00040			
33,000	.00115	.00020			Elastic limit.
34,000	.00590	.00475			
35,000	.00685	.00095			
36,000	.00765	.00080			
37,000	.00840	.00075			
38,000	.00925	.00085			
76,600					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,600
Elastic limit per square inch of original section	do...	33,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.8 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.19, ″.21*

No. 7278.

Marks, $\overset{\text{S 112}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00060	.00030			
30 000	.00100	.00040			
31,000	.00110	.00010			Elastic limit.
32,000	.00525	.00415			
33,000	.00650	.00125			
34,000	.00750	.00100			
35,000	.00805	.00055			
36,000	.00875	.00070			
76,600					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,600
Elastic limit per square inch of original section	do...	31,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do...	.00110
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.7 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.15, ″.17*

No. 7279.

Marks, $\overset{S\ 113}{P\ Y\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00060	.00030			
30,000	.00100	.00040			
40,000	.00140	.00040			Elastic limit.
41,000	.00875	.00735			
42,000	.00950	.00075			
43,000	.01000	.00050			
44,000	.01050	.00050			
45,000	.01160	.00110			
81,200					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,200
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.1000
Elongation per inch under strain at elastic limit	do...	.00140
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Position of rupture		″.65 from neck
Character of broken surface		silky 70 per cent, granular 30 per cent
Elongation of inch sections		″.12*, ″.08

No. 7285.

Marks, $\overset{S\ 114}{P\ Y\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00040	.00030			
20,000	.00065	.00025			
30,000	.00100	.00035			
31,000	.00110	.00010			Elastic limit.
32,000	.00760	.00650			
33,000	.00875	.00115			
34,000	.00965	.00090			
35,000	.01050	.00085			
36,000	.01225	.00175			
70,100					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,100
Elastic limit per square inch of original section	do...	31,000
Elongation per inch after rupture	inch..	.1100
Elongation per inch under strain at elastic limit	do...	.00110
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.75 from neck
Character of broken surface		dull silky 70 per cent, granular 30 per cent
Elongation of inch sections		″.12*, ″.10

No. 7286.

Marks, $\frac{\text{S 115}}{\text{P Y 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00065	.00035	....	....	
29,000	.00100	.00035	....	....	Elastic limit.
30,000	.00800	.00700	....	....	
31,000	.00890	.00090	....	....	
32,000	.00950	.00060	....	....	
33,000	.01025	.00075	....	....	
34,000	.01150	.00125	....	....	
66,250	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 66,250
Elastic limit per square inch of original section..do... 29,000
Elongation per inch after rupture ....inch.. .1100
Elongation per inch under strain at elastic limit..do... .00100
Reduction in diameter at point of rupture...do... .035
Reduction in area after rupture, per cent of original section.............................. 13.2
Position of rupture .... ".65 from neck
Character of broken surface .... granular, silky spot at circumference
Elongation of inch sections .... ".12*, ".10

No. 7287.

Marks, $\frac{\text{S 116}}{\text{P Y 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00105	.00045	....	....	Elastic limit.
31,000	.00665	.00560	....	....	
32,000	.00735	.00070	....	....	
33,000	.00820	.00085	....	....	
34,000	.00900	.00080	....	....	
35,000	.01000	.00100	....	....	
72,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 72,100
Elastic limit per square inch of original section ....do... 30,000
Elongation per inch after rupture ....inch.. .1900
Elongation per inch under strain at elastic limit ....do... .00105
Reduction in diameter at point of rupture..do... .055
Reduction in area after rupture, per cent of original section.............................. 20.5
Position of rupture... ".75 from neck
Character of broken surface .... granular, silky spot at circumference
Elongation of inch sections .... ".20*, ".18

No. 7348.

Marks, $\overset{S\ 117}{P\ Y\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00100	.00040	....	....	
34,000	.00130	.00030	....	....	Elastic limit.
35,000	.00800	.00670	....	....	
36,000	.00900	.00100	....	....	
37,000	.01000	.00100	....	....	
38,000	.01100	.00100	....	....	
39,000	.01150	.00050	....	....	
78,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	78,600
Elastic limit per square inch of original section	do...	34,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.00130
Reduction in diameter at point of rupture	do...	.075
Reduction in area after rupture, per cent of original section		27.4
Position of rupture		1".15 from neck
Character of broken surface		granular 50 per cent, silky 50 per cent
Elongation of inch sections		".25*, ".21

No. 7321.

Marks, $\overset{S\ 118}{P\ Y\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020	....	....	
20,000	.00070	.00035	....	....	
30,000	.00115	.00045	....	....	
31,000	.00120	.00005	....	....	
32,000	.00130	.00010	....	....	
33,000	.00135	.00005	....	....	Elastic limit.
34,000	.00270	.00135	....	....	
35,000	.00630	.00360	....	....	
36,000	.00700	.00070	....	....	
37,000	.00775	.00075	....	....	
38,000	.00865	.00090	....	....	
70,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,400
Elastic limit per square inch of original section	do...	33,000
Elongation per inch after rupture	inch..	.0700
Elongation per inch under strain at elastic limit	do...	.00135
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		".30 from neck
Character of broken surface		granular 70 per cent, silky 30 per cent
Elongation of inch sections		".11*, ".03

No. 7300.

Marks, $^{S\,119}_{P\,Y\,15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00065	.00035	....	....	
30,000	.00105	.00040	....	....	
33,000	.00115	.00010	....	....	Elastic limit.
34,000	.00130	.00015	....	....	
35,000	.00185	.00055	....	....	
36,000	.00250	.00065	....	....	
37,000	.00380	.00130	....	....	
38,000	.00475	.00095	....	....	
39,000	.00545	.00070	....	....	
89,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	89,900
Elastic limit per square inch of original section	do	33,000
Elongation per inch after rupture	inch	.1350
Elongation per inch under strain at elastic limit	do	.00115
Position of rupture		at the neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.13, ″.14

No. 7301.

Marks, $^{S\,120}_{P\,Y\,15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00070	.00040	....	....	
29,000	.00110	.00040	....	....	
30,000	.00115	.00005	....	....	Elastic limit.
31,000	.00130	.00015	....	....	
32,000	.00155	.00025	....	....	
33,000	.00635	.00480	....	....	
34,000	.00700	.00065	....	....	
35,000	.00770	.00070	....	....	
75,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	75,500
Elastic limit per square inch of original section	do	30,000
Elongation per inch after rupture	inch	.1250
Elongation per inch under strain at elastic limit	do	.00115
Reduction in diameter at point of rupture		.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.55 from neck
Character of broken surface granular, silky spot at circumference containing a hole ″.04 diameter		
Elongation of inch sections		″.12, ″.13

No. 7302.

Marks, $\overset{\text{S 121}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00060	.00030			
30,000	.00100	.00040			
39,000	.00135	.00035			
40,000	.00140	.00005			Elastic limit.
41,000	.00210	.00070			
42,000	.00325	.00115			
43,000	.00575	.00250			
44,000	.00630	.00055			
45,000	.00700	.00070			
84,450					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 84,450
Elastic limit per square inch of original section ....do... 40,000
Elongation per inch after rupture........inch.. .0550
Elongation per inch under strain at elastic limit ....do... .00140
Reduction in diameter at point of rupture........do... .025
Reduction in area after rupture, per cent of original section........ 9.5
Position of rupture........ ″.90 from neck
Character of broken surface..... granular, silky spot at circumference containing hole ″.09 diameter
Elongation of inch sections........ ″.05, ″.06*

No. 7349.

Marks, $\overset{\text{S 123}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00065	.00035			
24,000	.00090	.00025			
25,000	.00095	.00005			Elastic limit.
26,000	.00120	.00025			
27,000	.00150	.00030			
28,000	.00200	.00050			
29,000	.00255	.00055			
30,000	.00355	.00100			
31,000	.00420	.00065			
32,000	.00490	.00070			
71,400					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 71,400
Elastic limit per square inch of original section ....do... 25,000
Elongation per inch after rupture ....inch.. .1500
Elongation per inch under strain at elastic limit ....do... .00095
Reduction in diameter at point of rupture........do... .035
Reduction in area after rupture, per cent of original section........ 13.2
Position of rupture .... 1″.13 from neck
Character of broken surface .... medium, coarse, granular; dull silky spot at circumference
Elongation of inch sections........ ″.17*, ″.13

No. 7350

Marks, $\frac{\text{S 125}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
28,000	.00095	.00035	....	....	Elastic limit.
29,000	.00120	.00025	....	....	
30,000	.00250	.00130	....	....	
31,000	.00375	.00125	....	....	
32,000	.00445	.00070	....	....	
33,000	.00500	.00055	....	....	
70,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,900
Elastic limit per square inch of original section	do...	28,000
Elongation per inch after rupture	inch..	.1750
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.90 from neck
Character of broken surface		medium, fine, granular; dull silky spot at circumference
Elongation of inch sections		″.20*, ″.15

No. 7360.

Marks, $\frac{\text{S 126}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00105	.00045	....	....	
34,000	.00125	.00020	....	....	Elastic limit.
35,000	.00625	.00500	....	....	
36,000	.00810	.00185	....	....	
37,000	.00900	.00090	....	....	
38,000	.00975	.00075	....	....	
39,000	.01035	.00060	....	....	
73,800	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	73,800
Elastic limit per square inch of original section	do...	34,000
Elongation per inch after rupture	inch..	.0950
Elongation per inch under strain at elastic limit	do...	.00125
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Position of rupture		″.7 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.08, ″.11*

No. 7351.

Marks, $\overset{\text{S 128}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
30,000	.00100	.00035	....	....	
32,000	.00120	.00020	....	....	Elastic limit.
33,000	.00145	.00025	....	....	
34,000	.00950	.00805	....	....	
35,000	.01100	.00150	....	....	
36,000	.01175	.00075	....	....	
37,000	.01250	.00075	....	....	
73,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	73,000
Elastic limit per square inch of original section	do...	32,000
Elongation per inch after rupture	inch..	.2450
Elongation per inch under strain at elastic limit	do...	.00120
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1″.2 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.25*, ″.24

No. 7361.

Marks, $\overset{\text{S 137}}{\text{P Y 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
30,000	.00100	.00035	....	....	
36,000	.00135	.00035	....	....	Elastic limit.
37,000	.00900	.00765	....	....	
38,000	.00975	.00075	....	....	
39,000	.01060	.00085	....	....	
40,000	.01150	.00090	....	....	
41,000	.01240	.00090	....	....	
76,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,900
Elastic limit per square inch of original section	do...	36,000
Elongation per inch after rupture	inch..	.1950
Elongation per inch under strain at elastic limit	do...	.00135
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1″ from neck
Character of broken surface		granular 60 per cent, silky 40 per cent
Elongation of inch sections		″.19, ″.20*

No. 7324.

Marks, $\frac{\text{P Y 92-15}}{1}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015			
20,000	.00065	.00035			
25,000	.00090	.00025			
27,000	.00100	.00010			
28,000	.00105	.00005			Elastic limit.
29,000	.00225	.00120			
30,000	.00500	.00275			
31,000	.00600	.00100			
32,000	.00665	.00065			
33,000	.00740	.00075			
61,900					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	61,900
Elastic limit per square inch of original section	do	28,000
Elongation per inch after rupture	inch	.0450
Elongation per inch under strain at elastic limit	do	.00105
Reduction in diameter at point of rupture	do	.015
Reduction in area after rupture, per cent of original section		5.7
Position of rupture		″.40 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.05*, ″.04

No. 7325.

Marks, $\frac{\text{P Y 92-15}}{2}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015			
20,000	.00070	.00040			
25,000	.00090	.00020			
26,000	.00095	.00005			
27,000	.00100	.00005			Elastic limit.
28,000	.00115	.00015			
29,000	.00190	.00075			
30,000	.00380	.00190			
31,000	.00485	.00105			
32,000	.00575	.00090			
33,000	.00650	.00075			
60,250					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	60,250
Elastic limit per square inch of original section	do	27,000
Elongation per inch after rupture	inch	.0400
Elongation per inch under strain at elastic limit	do	.00100
Reduction in diameter at point of rupture	do	.015
Reduction in area after rupture, per cent of original section		5.7
Position of rupture		″.50 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.04*, ″.04

No. 7326.

Marks, $^{\mathrm{P\ Y\ 92\text{-}15}}_{3}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
25,000	.00090	.00030	....	....	
26,000	.00095	.00005	....	....	Elastic limit.
27,000	.00135	.00040	....	....	
28,000	.00175	.00040	....	....	
29,000	.00300	.00125	....	....	
30,000	.00410	.00110	....	....	
31,000	.00495	.00085	....	....	
32,000	.00565	.00070	....	....	
74,950	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	74,950
Elastic limit per square inch of original section	do...	26,000
Elongation per inch after rupture	inch..	.0950
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		″.46 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.09, ″.10*

No. 7327.

Marks, $^{\mathrm{P\ Y\ 92\text{-}15}}_{4}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
25,000	.00085	.00025	....	....	
27,000	.00095	.00010	....	....	
28,000	.00100	.00005	....	....	Elastic limit.
29,000	.00175	.00075	....	....	
30,000	.00460	.00285	....	....	
31,000	.00530	.00070	....	....	
32,000	.00610	.00080	....	....	
33,000	.00735	.00125	....	....	
75,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	75,400
Elastic limit per square inch of original section	do...	28,000
Elongation per inch after rupture	inch..	.1000
Elongation per inch under strain at elastic limit	do..	.00100
Reduction in diameter at point of rupture	do..	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		1″.08 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.10*, ″.10

PIVOT YOKES OF 15-POUNDER GUN MOUNTS, STEEL CASTINGS.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		″ ″
7262	S 75 3 P Y 15	.505	.20	29,000	72,600	17.5	20.5	Granular, silky spot at circumference	.17, .18*
7212	S 82 P Y 15	.505	.20	27,000	69,200	19.5	20.5	Granular 60 per cent, silky 40 per cent	.17, .22*
7226	S 84 P Y 15	.505	.20	33,000	49,900	5.5	5.7	Silky, trace of granulation	.08*, .03
7263	S 88 2 P Y 15	.505	.20	33,000	75,900	21.0	23.9	Granular, silky spot at circumference	.23*, .19
7264	S 90 2 P Y 15	.505	.20	26,000	68,900	23.5	30.7	Dull silky	.28*, .19
7271	S 91 2 P Y 15	.505	.20	34,000	74,400	17.5	20.5	Granular, silky spot at circumference	.16, .19*
7249	S 92 P Y 15	.505	.20	29,000	70,900	6.5	9.5	....do	.06, .07*
7265	S 93 P Y 15	.505	.20	29,000	69,500	16.0	20.5	Granular 60 per cent, dull amorphous 40 per cent	.14, .18*
7272	S 94 2 P Y 15	.505	.20	35,000	75,500	15.0	16.9	Granular, silky spot at circumference	.16*, .14
7284	S 95 P Y 15	.505	.20	29,000	71,100	6.5	5.7	....do	.06, .07*
7227	S 96 P Y 15	.505	.20	25,000	62,850	14.0	16.9	Granular, silvery luster, silky spot at circumference	.14, .14*
7266	S 96 2 P Y 15	.505	.20	29,000	77,000	18.5	20.5	Granular, silky spot at circumference	.20*, .17
7250	S 97 P Y 15	.505	.20	27,000	64,000	22.5	23.9	Granular 80 per cent, silky 20 per cent	.20, .25*
7228	S 100 P Y 15	.505	.20	31,000	69,700	10.0	13.2	Granular, silky spot at circumference	.11*, .09
7267	S 100 2 P Y 15	.505	.20	35,000	73,700	18.0	20.5	Granular 80 per cent, silky 20 per cent	.17, .19*
7229	S 101 P Y 15	.505	.20	33,000	72,500	20.0	20.5	Granular 85 per cent, silky 15 per cent	.17, .28*
7251	S 102 P Y 15	.505	.20	26,000	68,700	13.5	16.9	....do	.18*, .14
7252	S 106 P Y 15	.505	.20	30,000	68,450	9.5	....	Granular 85 per cent, silky 15 per cent, silky section has blow-hole ″.10 diameter	.09. .10
7268	S 107 P Y 15	.505	.20	24,000	66,900	15.0	16.9	Granular, brilliant facets	.13, .17*
7255	S 108 P Y 15	.505	.20	20,000	62,400	18.5	20.5	....do	.19*, .18

7256	S 109 P Y 15	.505	.20	25,000	64,750	8.0	9.5	Granular, silky spot at circumference	.09*, .07
7276	S 110 P Y 15	.505	.20	29,000	64,500	8.5	13.2	Dull silky, oblique; contains a sand spot ″.10 diameter	.06, .11*
7277	S 111 P Y 15	.505	.20	33,000	76,600	20.0	20.5	Granular, silky spot at circumference	.19, .21*
7278	S 112 P Y 15	.505	.20	31,000	76,600	16.0	16.9	.....do	.15, .17*
7279	S 113 P Y 15	.505	.20	40,000	81,200	10.0	13.2	Granular 30 per cent; silky 70 per cent	.12*, .08
7285	S 114 P Y 15	.505	.20	31,000	70,100	11.0	16.9	Granular 30 per cent, dull silky 70 per cent	.12*, .10
7286	S 115 P Y 15	.505	.20	29,000	66,250	11.0	13.2	Granular, silky spot at circumference	.12*, .10
7287	S 116 P Y 15	.505	.20	30,000	72,100	19.0	20.5	.....do	.20*, .18
7348	S 117 P Y 15	.505	.20	34,000	78,600	23.0	27.4	Granular 50 per cent, silky 50 per cent	.25*, .21
7321	S 118 P Y 15	.505	.20	33,000	70,400	7.0	9.5	Granular 70 per cent, silky 30 per cent	.11*, .08
7300	S 119 P Y 15	.505	.20	33,000	89,900	13.5	....	Granular, silky spot at circumference	.13, .14
7301	S 120 P Y 15	.505	.20	30,000	75,500	12.5	16.9	Granular, silky spot at circumference containing a hole ″.04 diameter	.12, .13*
7302	S 121 P Y 15	.505	.20	30,000	84,450	5.5	9.5	Granular, silky spot at circumference containing a hole ″.09 diameter	.05, .06*
7344	S 123 P Y 15	.505	.20	25,000	71,400	15.0	13.2	Medium coarse granular, dull silky spot at circumference	.17*, .18
7350	S 125 P Y 15	.505	.20	28,000	70,900	17.5	20.5	Medium fine granular, dull silky spot at circumference	.20*, .15
7360	S 126 P Y 15	.505	.20	34,000	73,800	9.5	13.2	Granular, silky spot at circumference	.08, .11*
7351	S 128 P Y 15	.505	.20	32,000	73,000	24.5	30.7	.....do	.25*, .24
7361	S 137 P Y 15	.505	.20	36,000	76,900	19.5	20.5	Granular 60 per cent, silky 40 per cent	.19, .20*
7324	P Y 92-15 1	.505	.20	28,000	61,900	4.5	5.7	Granular 85 per cent, silky 15 per cent	.05*, .04
7325	P Y 92-15 2	.505	.20	27,000	60,250	4.0	5.7	.....do	.04*, .04
7326	P Y 92-15 3	.505	.20	26,000	74,950	9.5	9.5	.....do	.09, .10*
7327	P Y 92-15 4	.505	.20	28,000	75,400	10.0	9.5	Granular, silky spot at circumference	.10*, .10

INNER BASES—15-POUNDER GUN MOUNTS.

STEEL CASTINGS.

No. 7257.

Marks, $\overset{\text{A 75}}{\text{3 I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
30,000	.00105	.00045	....	....	
31,000	.00115	.00010	....	....	Elastic limit.
32,000	.00890	.00775	....	....	
33,000	.00940	.00050	....	....	
34,000	.00990	.00050	....	....	
35,000	.01075	.00085	....	....	
36,000	.01205	.00130	....	....	
72,300	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	72,300
Elastic limit per square inch of original section ....do...	31,000
Elongation per inch after rupture....................................inch..	.1900
Elongation per inch under strain at elastic limit ....do...	.00115
Reduction in diameter at point of rupture....................................do...	.055
Reduction in area after rupture, per cent of original section....................................	20.5
Position of rupture	".95 from neck
Character of broken surface	granular 50 per cent, dull amorphous 50 per cent
Elongation of inch sections....................................	".21*, ".17

No. 7215.

Marks, $\overset{\text{A 32}}{\text{I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	Elastic limit.
31,000	.00615	.00515	....	....	
32,000	.00705	.00090	....	....	
33,000	.00765	.00060	....	....	
34,000	.00860	.00095	....	....	
35,000	.00950	.00090	....	....	
73,200	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................................pounds..	73,200
Elastic limit per square inch of original section....................................do...	30,000
Elongation per inch after rupture ....inch..	.1700
Elongation per inch under strain at elastic limit....................................do...	.00100
Reduction in diameter at point of rupture....................................do...	.045
Reduction in area after rupture, per cent of original section....................................	16.9
Position of rupture	".9 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections....................................	".18*, ".16

No. 7237.

Marks, $\overset{\text{A 82}}{\text{2 I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00005	.00005	0.	0.	
10,000	.00020	.00015	....	....	
20,000	.00055	.00035	....	....	
25,000	.00085	.00030	....	....	
26,000	.00095	.00010	....	....	Elastic limit.
27,000	.00130	.00035	....	....	
28,000	.00150	.00020	....	....	
29,000	.00200	.00050	....	....	
30,000	.00245	.00045	....	....	
31,000	.00320	.00075	....	....	
32,000	.00395	.00075	....	....	
33,000	.00465	.00070	....	....	
68,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,500
Elastic limit per square inch of original section	do...	26,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per centum of original section		16.[illegible]
Position of rupture		1".08 from neck
Character of broken surface		granular, silvery luster 80 per cent, silky 20 per cent
Elongation of inch sections		".15, ".19

No. 7216.

Marks, $\overset{\text{A 83}}{\text{I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, .2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
27,000	.00085	.00025	....	....	Elastic limit.
28,000	.00400	.00315	....	....	
29,000	.00500	.00100	....	....	
30,000	.00595	.00095	....	....	
31,000	.00655	.00060	....	....	
32,000	.00760	.00105	....	....	
68,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,450
Elastic limit per square inch of original section	do...	27,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.00085
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1" from neck
Character of broken surface		granular 70 per cent, silky 30 per cent
Elongation of inch sections		".19, ".23

No. 7209.

Marks, $\overset{\text{A 84}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
81,000	.00105	.00005	....	....	Elastic limit.
32,000	.00915	.00810	....	....	
33,000	.00995	.00080	....	....	
34,000	.01100	.00105	....	....	
35,000	.01190	.00090	....	....	
36,000	.01300	.00110	....	....	
70,300	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ......pounds..	70,300
Elastic limit per square inch of original section ......do...	31,000
Elongation per inch after rupture ......inch..	.2150
Elongation per inch under strain at elastic limit ......do...	.00105
Reduction in diameter at point of rupture ......do..	.055
Reduction in area after rupture, per cent of original section	20.5
Position of rupture	″.95 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	″.23*, ″.20

No. 7210.

Marks, $\overset{\text{A 85}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00005	.00005	0.	0.	
10,000	.00025	.00020	....	....	
20,000	.00060	.00035	....	....	
30,000	.00100	.00040	....	....	
32,000	.00110	.00010	....	....	Elastic limit.
33,000	.01015	.00905	....	....	
34,000	.01140	.00125	....	....	
35,000	.01200	.00060	....	....	
36,000	.01315	.00115	....	....	
37,000	.01525	.00210	....	....	
69,800	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ......pounds..	69,800
Elastic limit per square inch of original section ......do...	32,000
Elongation per inch after rupture ......inch..	.2050
Elongation per inch under strain at elastic limit ......do...	.00110
Reduction in diameter at point of rupture ......do...	.055
Reduction in area after rupture, per cent of original section	20.5
Position of rupture	″.7 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	″.19, ″.22*

No. 7211.

Marks, $\overset{\text{A 86}}{\text{I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00065	.00035	....	....	
30,000	.00105	.00040	....	....	Elastic limit.
	.00475	.00370	....	....	
31,000	.00750	.00275	....	....	
32,000	.00825	.00075	....	....	
33,000	.00885	.00060	....	....	
34,000	.01000	.00115	....	....	
35,000	.01085	.00085	....	....	
70,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,450
Elastic limit per square inch of original section	do...	30,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00105
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".95 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".17*, ".15

No. 7238.

Marks, $\overset{\text{A 86}}{\text{2 I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00070	.00040	....	....	
22,000	.00090	.00020	....	....	
23,000	.00100	.00010	....	....	Elastic limit.
24,000	.00195	.00095	....	....	
25,000	.00290	.00095	....	....	
26,000	.00365	.00075	....	....	
27,000	.00475	.00110	....	....	
28,000	.00605	.00130	....	....	
66,850	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	66,550
Elastic limit per square inch of original section	do...	23,000
Elongation per inch after rupture	inch..	.1950
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		".40 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".17, ".2*

No. 7221.

Marks, $\overset{\text{A 87}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
32,000	.00110	.00010	....	....	
33,000	.00115	.00005	....	....	Elastic limit.
34,000	.00850	.00735	....	....	
35,000	.00925	.00075	....	....	
36,000	.01005	.00080	....	....	
37,000	.01095	.00090	....	....	
38,000	.01175	.00080	....	....	
73,950	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	73,950
Elastic limit per square inch of original section .... do...	33,000
Elongation per inch after rupture .... inch..	.1650
Elongation per inch under strain at elastic limit .... do...	.00115
Reduction in diameter at point of rupture .... do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	″.70 from neck
Character of broken surface	granular 80 per cent, silky 20 per cent
Elongation of inch sections	″.18*, ″.15

No. 7222.

Marks, $\overset{\text{A 88}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020	....	....	
20,000	.00070	.00035	....	....	
25,000	.00100	.00030	....	....	
29,000	.00120	.00020	....	....	
30,000	.00125	.00005	....	....	Elastic limit.
31,000	.00630	.00505	....	....	
32,000	.00700	.00070	....	....	
33,000	.00755	.00055	....	....	
34,000	.00795	.00040	....	....	
35,000	.00865	.00070	....	....	
36,000	.00950	.00085	....	....	
74,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	74,500
Elastic limit per square inch of original section .... do...	30,000
Elongation per inch after rupture .... inch..	.1400
Elongation per inch under strain at elastic limit .... do...	.00125
Reduction in diameter at point of rupture .... do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	″.28 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	″.13, ″.15*

No. 7258.

Marks, $\overset{\text{A 88}}{\text{2 I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00060	.00030			
30,000	.00100	.00040			
34,000	.00115	.00015			Elastic limit.
35,000	.01050	.00935			
36,000	.01100	.00050			
37,000	.01155	.00055			
38,000	.01290	.00135			
39,000	.01410	.00120			
73,550					Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds.. 73,550
Elastic limit per square inch of original section .... do... 34,000
Elongation per inch after rupture .... inch.. .2150
Elongation per inch under strain at elastic limit .... do... .00115
Reduction in diameter at point of rupture .... do... .065
Reduction in area after rupture, per cent of original section 23.9
Position of rupture .... at middle of stem
Character of broken surface .... granular 30 per cent; dull amorphous 70 per cent
Elongation of inch sections .... ".22, ".21

No. 7223.

Marks, $\overset{\text{A 89}}{\text{I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020			
20,000	.00075	.00040			
23,000	.00090	.00015			
24,000	.00095	.00005			Elastic limit.
25,000	.00850	.00755			
26,000	.00960	.00110			
27,000	.01020	.00060			
28,000	.01190	.00170			
29,000	.01250	.00060			
57,400					Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds.. 57,400
Elastic limit per square inch of original section .... do... 24,000
Elongation per inch after rupture .... inch.. .2100
Elongation per inch under strain at elastic limit .... do... .00095
Reduction in diameter at point of rupture .... do... .075
Reduction in area after rupture, per cent of original section 27.4
Position of rupture .... ".85 from neck
Character of broken surface .... silky, trace of granulation
Elongation of inch sections .... ".15, ".27

No. 7259.

Marks, $\overset{\text{A 89}}{\text{2 I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
80,000	.00105	.00045	....	....	
33,000	.00120	.00015	....	....	Elastic limit.
34,000	.00850	.00730	....	....	
35,000	.00950	.00100	....	....	
36,000	.01000	.00050	....	....	
37,000	.01090	.00090	....	....	
38,000	.01190	.00100	....	....	
74,800	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	74,800
Elastic limit per square inch of original section	do...	33,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do...	.00120
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		1".1 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".17*, ".15

No. 7239.

Marks, $\overset{\text{A 90}}{\text{I B 15}}$.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00065	.00035	....	....	
30,000	.00110	.00045	....	....	
32,000	.00115	.00005	....	....	
33,000	.00120	.00005	....	....	
34,000	.00130	.00010	....	....	Elastic limit.
35,000	.00975	.00845	....	....	
36,000	.01000	.00025	....	....	
87,000	.01050	.00050	....	....	
38,000	.01150	.00100	....	....	
39,000	.01250	.00100	....	....	
73,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	73,100
Elastic limit per square inch of original section	do...	34,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.00130
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		".80 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		".15, ".19*

No. 7253.

Marks, $\overset{\text{A 91}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
35,000	.00120	.00020	....	....	Elastic limit.
36,000	.00850	.00730	....	....	
37,000	.00900	.00050	....	....	
38,000	.00965	.00065	....	....	
39,000	.01050	.00085	....	....	
40,000	.01150	.00100	....	....	
77,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................pounds.. 77,600
Elastic limit per square inch of original section....................do... 35,000
Elongation per inch after rupture....................inch.. .12
Elongation per inch under strain at elastic limit....................do... .00120
Reduction in diameter at point of rupture....................do... .065
Reduction in area after rupture, per cent of original section.................... 12.2
Position of rupture.................... ″.45 from neck
Character of broken surface.................... granular, silky spot at circumference
Elongation of inch sections.................... ″.13*, ″.1

No. 7254.

Marks, $\overset{\text{A 92}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
30,000	.00105	.00040	....	....	Elastic limit.
31,000	.00880	.00775	....	....	
32,000	.00925	.00045	....	....	
33,000	.00975	.00050	....	....	
34,000	.01050	.00075	....	....	
35,000	.01150	.00100	....	....	
71,300	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................pounds.. 71,300
Elastic limit per square inch of original section....................do... 30,000
Elongation per inch after rupture....................inch.. .2000
Elongation per inch under strain at elastic limit....................do... .00105
Reduction in diameter at point of rupture....................do... .065
Reduction in area after rupture, per cent of original section.................... 23.9
Position of rupture.................... 1″.04 from neck
Character of broken surface.................... granular 60 per cent, silky 40 per cent
Elongation of inch sections.................... ″.23*, ″.17

No. 7260.

Marks, $\overset{A\ 93}{I\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
28,000	.00105	.00045	....	....	Elastic limit.
29,000	.00650	.00545	....	....	
30,000	.00750	.00100	....	....	
31,000	.00800	.00050	....	....	
32,000	.00865	.00065	....	....	
33,000	.00960	.00095	....	....	
70,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	70,500
Elastic limit per square inch of original section	do	28,000
Elongation per inch after rupture	inch	.1250
Elongation per inch under strain at elastic limit	do	.00105
Reduction in diameter at point of rupture	do	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		1″. from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.12, ″.13*

No. 7261.

Marks, $\overset{A\ 94}{I\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00040	.00030	....	....	
20,000	.00065	.00025	....	....	
29,000	.00105	.00040	....	....	Elastic limit.
30,000	.00125	.00020	....	....	
31,000	.00145	.00020	....	....	
32,000	.00525	.00380	....	....	
33,000	.00650	.C0125	....	....	
34,000	.00750	.00100	....	....	
77,800	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	77,800
Elastic limit per square inch of original section	do	29,000
Elongation per inch after rupture	inch	.1550
Elongation per inch under strain at elastic limit	do	.00105
Reduction in diameter at point of rupture	do	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		1.″05 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.15, ″.16*

No. 7280.

Marks, $\overset{\text{A 95}}{\text{I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00100	.00040	....	....	
32,000	.00105	.00005	....	....	Elastic limit.
33,000	.00750	.00645	....	....	
34,000	.00835	.00085	....	....	
35,000	.00900	.00065	....	....	
36,000	.01000	.00100	....	....	
37,000	.01100	.00100	....	....	
74,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	74,100
Elastic limit per square inch of original section ....do...	32,000
Elongation per inch after rupture ....inch..	.1600
Elongation per inch under strain at elastic limit ....do...	.00105
Reduction in diameter at point of rupture ....do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	".75 from neck
Character of broken surface	granular 80 per cent, silky 20 per cent
Elongation of inch sections	".18*, ".14

No. 7281.

Marks, $\overset{\text{A 96}}{\text{I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00095	.00035	....	....	
32,000	.00105	.00010	....	....	Elastic limit.
33,000	.00825	.00720	....	....	
34,000	.00850	.00025	....	....	
35,000	.00880	.00030	....	....	
36,000	.00945	.00065	....	....	
37,000	.01060	.00115	....	....	
73,800	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	73,800
Elastic limit per square inch of original section ....do...	32,000
Elongation per inch after rupture ....inch..	.180
Elongation per inch under strain at elastic limit ....do...	.00105
Reduction in diameter at point of rupture ....do...	.065
Reduction in area after rupture, per cent of original section	20.5
Position of rupture	".75 from neck
Character of broken surface	granular 60 per cent, dull silky 40 per cent
Elongation of inch sections	".15, ".2*

No. 7282.

Marks, $\overset{A\ 97}{I\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00095	.00035	....	....	
37,000	.00140	.00045	....	....	Elastic limit.
38,000	.00805	.00665	....	....	
39,000	.00900	.00095	....	....	
40,000	.00955	.00055	....	....	
41,000	.01050	.00095	....	....	
42,000	.01110	.00060	....	....	
79,800	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79,800
Elastic limit per square inch of original section	do...	37,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.00140
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1″ from neck
Character of broken surface		granular 60 per cent, silky 40 per cent
Elongation of inch sections		″.20*, ″.16

No. 7299.

Marks, $\overset{A\ 98}{I\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00020	.00010	....	....	
20,000	.00055	.00035	....	....	
25,000	.00080	.00025	....	....	
28,000	.00095	.00015	....	....	
29,000	.00100	.00005	....	....	Elastic limit.
30,000	.00105	.00005	....	....	
	.00715	.00610	....	....	
31,000	.00750	.00035	....	....	
32,000	.00820	.00070	....	....	
33,000	.00910	.00090	....	....	
34,000	.01000	.00090	....	....	
35,000	.01100	.00100	....	....	
69,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	69,500
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.1450
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1.″06 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.14*, ″.15

No. 7308.

Marks, $\substack{\text{A 99}\\ \text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015			
20,000	.00065	.00035			
30,000	.00110	.00045			
32,000	.00120	.00010			Elastic limit.
33,000	.00940	.00820			
34,000	.00960	.00020			
35,000	.01025	.00065			
36,000	.01100	.00075			
37,000	.01210	.00110			
71,400					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	71,400
Elastic limit per square inch of original section	do...	32,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00120
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.95 from neck
Character of broken surface		granular 80 per cent, dull silky 20 per cent
Elongation of inch sections		″.14, ″.16*

No. 7309.

Marks, $\substack{\text{A 100}\\ \text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020			
20,000	.00070	.00035			
30,000	.00105	.00035			
34,000	.00125	.00020			
35,000	.00135	.00010			Elastic limit.
36,000	.00815	.00680			
37,000	.00875	.00060			
38,000	.00960	.00085			
39,000	.01030	.00070			
40,000	.01115	.00085			
77,000					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	77,000
Elastic limit per square inch of original section	do...	35,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00135
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.90 from neck
Character of broken surface		granular 80 per cent, dull silky 20 per cent
Elongation of inch sections		″.16*, ″.14

No. 7310.

Marks, $\overset{\text{A 101}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015			
20,000	.00060	.00030			
30,000	.00105	.00045			
32,000	.00110	.00005			Elastic limit.
33,000	.00875	.00765			
34,000	.00900	.00025			
35,000	.00925	.00025			
36,000	.01000	.00075			
37,000	.01075	.00075			
74,900					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	74,900
Elastic limit per square inch of original section	do...	32,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.00110
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.58 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.15, ″.19*

No. 7311.

Marks, $\overset{\text{A 102}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015			
20,000	,00065	.00035			
30,000	.00105	.00040			
33,000	.00120	.00015			
34,000	.00125	.00005			Elastic limit.
35,000	.00770	.00645			
36,000	.00830	.00060			
37,000	.00900	.00070			
38,000	.01000	.00100			
39,000	.01090	.00090			
76,550					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,550
Elastic limit per square inch of original section	do...	34,000
Elongation per inch after rupture	inch..	.1750
Elongation per inch under strain at elastic limit	do...	.00125
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.92 from neck
Character of broken surface		granular 80 per cent, dull silky 20 per cent
Elongation of inch sections		″.17, ″.18*

No. 7312.

Marks, $\substack{\text{A 103}\\ \text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015			
20,000	.00065	.00035			
30,000	.00105	.00040			
34,000	.00120	.00015			
35,000	.00130	.00010			Elastic limit.
36,000	.00900	.00770			
37,000	.00950	.00050			
38,000	.01000	.00050			
39,000	.01075	.00075			
40,000	.01170	.00095			
75,500					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	75,500
Elastic limit per square inch of original section	do...	35,000
Elongation per inch after rupture	inch..	.1350
Elongation per inch under strain at elastic limit	do...	.00130
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.60 from neck
Character of broken surface		granular 60 per cent, dull silky 40 per cent
Elongation of inch sections		″.12, ″.15*

No. 7313.

Marks, $\substack{\text{A 104}\\ \text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015			
20,000	.00070	.00040			
25,000	.00095	.00025			
28,000	.00110	.00015			
29,000	.00115	.00005			Elastic limit.
30,000	.00590	.00475			
31,000	.00650	.00060			
32,000	.00750	.00100			
33,000	.00825	.00075			
34,000	.00900	.00075			
62,850					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	62,850
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.0650
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		″.76 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.05, ″.06*

No. 7314.

Marks, $\overset{\text{A 105}}{\text{I B 15}}$
Diameter, ''.505.
Sectional area, .20 square inch.
Gauged length, 2''.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
30,000	.00105	.00045	....	....	
33,000	.00120	.00015	....	....	
34,000	.00125	.00005	....	....	Elastic limit.
35,000	.00700	.00575	....	....	
36,000	.00760	.00060	....	....	
37,000	.00840	.00080	....	....	
38,000	.00915	.00075	....	....	
39,000	.01000	.00085	....	....	
79,050	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	79,050
Elastic limit per square inch of original section .... do...	34,000
Elongation per inch after rupture .... inch..	.2000
Elongation per inch under strain at elastic limit .... do...	.00125
Reduction in diameter at point of rupture .... do...	.065
Reduction in area after rupture, per cent of original section	23.9
Position of rupture	''.70 from neck
Character of broken surface	granular 50 per cent, silky 50 per cent
Elongation of inch sections	''.17, ''.23*

No. 7315.

Marks, $\overset{\text{A 106}}{\text{I B 15}}$
Diameter, ''.505.
Sectional area, .20 square inch.
Gauged length, 2''.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00070	.00040	....	....	
25,000	.00100	.00030	....	....	
27,000	.00110	.00010	....	....	
28,000	.00115	.00005	....	....	Elastic limit.
29,000	.00130	.00015	....	....	
30,000	.00290	.00160	....	....	
31,000	.00525	.00235	....	....	
32,000	.00700	.00175	....	....	
33,000	.00755	.00055	....	....	
34,000	.00890	.00135	....	....	
73,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	73,400
Elastic limit per square inch of original section .... do...	28,000
Elongation per inch after rupture .... inch..	.1800
Elongation per inch under strain at elastic limit .... do...	.00115
Reduction in diameter at point of rupture .... do...	.055
Reduction in area after rupture, per cent of original section	20.5
Position of rupture	1'' from neck
Character of broken surface	granular 75 per cent, silky 25 per cent
Elongation of inch sections	''.19*, ''.17

No. 7335.

Marks, $\overset{\text{A 107}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00060	.00035	....	....	
25,000	.00080	.00020	....	....	
29,000	.00105	.00025	....	....	
30,000	.00110	.00005	....	....	Elastic limit.
31,000	.00710	.00600	....	....	
32,000	.00750	.00040	....	....	
33,000	.00825	.00075	....	....	
34,000	.00920	.00095	....	....	
35,000	.01000	.00080	....	....	
72,950	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,950
Elastic limit per square inch of original section	do...	30,000
Elongation per inch after rupture	inch..	.2060
Elongation per inch under strain at elastic limit	do...	.00110
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″.15 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.21, ″.20*

No. 7342.

Marks, $\overset{\text{A 108}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00040	.00030	....	....	
20,000	.00070	.00030	....	....	
30,000	.00105	.00035	....	....	
33,000	.00135	.00030	....	....	Elastic limit.
34,000	.00700	.00565	....	....	
35,000	.00790	.00090	....	....	
36,000	.00860	.00070	....	....	
37,000	.00925	.00065	....	....	
38,000	.01025	.00100	....	....	
80,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,100
Elastic limit per square inch of original section	do...	33,000
Elongation per inch after rupture	inch..	.2050
Elongation per inch under strain at elastic limit	do...	.00135
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″.1 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.20, ″.21*

No. 7343.

Marks, $\overset{\text{A 109}}{\text{I B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00070	.00035	....	....	
30,000	.00100	.00030	....	....	
40,000	.00145	.00045	....	....	Elastic limit.
41,000	.00740	.00595	....	....	
42,000	.00775	.00035	....	....	
43,000	.00835	.00060	....	....	
44,000	.00900	.00065	....	....	
45,000	.00950	.00050	....	....	
90,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	90,600
Elastic limit per square inch of original section .... do...	40,000
Elongation per inch after rupture .... inch..	.1900
Elongation per inch under strain at elastic limit .... do...	.00145
Reduction in diameter at point of rupture .... do...	.055
Reduction in area after rupture, per cent of original section	20.5
Position of rupture	″.95 from neck
Character of broken surface	granular 20 per cent, dull silky 80 per cent
Elongation of inch sections	″.22*, ″.16

No. 7344.

Marks, $\overset{\text{A 110}}{\text{I B 15}}$
Diameter ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00040	.00030	....	....	
20,000	.00070	.00030	....	....	
30,000	.00100	.00030	....	....	
35,000	.00130	.00030	....	....	Elastic limit.
36,000	.00800	.00670	....	....	
37,000	.00850	.00050	....	....	
38,000	.00910	.00060	....	....	
39,000	.00975	.00065	....	....	
40,000	.01050	.00075	....	....	
80.350	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	80,350
Elastic limit per square inch of original section .... do...	35,000
Elongation per inch after rupture .... inch..	.1700
Elongation per inch under strain at elastic limit .... do...	.00130
Reduction in diameter at point of rupture .... do...	.055
Reduction in area after rupture, per cent of original section	20.5
Position of rupture	″.60 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	″.20*, ″.14

No. 7345.

Marks, $\overset{\text{A 111}}{\text{I B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00070	.00035	....	....	
30,000	.00100	.00030	....	....	
39,000	.00150	.00050	....	....	Elastic limit.
40,000	.00170	.00020	....	....	
41,000	.00200	.00030	....	....	
42,000	.00605	.00405	....	....	
43,000	.00695	.00090	....	....	
44,000	.00775	.00080	....	....	
94,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds.. 94,400
Elastic limit per square inch of original section	do... 39,000
Elongation per inch after rupture	inch.. .190
Elongation per inch under strain at elastic limit	do... .00150
Reduction in diameter at point of rupture	do... .065
Reduction in area after rupture, per cent of original section	23.9
Position of rupture	".95 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	".17, ".21

TABULATION.

INNER BASES OF 15-POUNDER GUN MOUNTS, STEEL CASTINGS.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		*Inch.*
7257	A 75 3 I B 15	.505	.20	31,000	72,300	19.0	20.5	Granular 50 per cent, dull amorphous 50 per cent	.21*, .17
7215	A 82 I B 15	.505	.20	30,000	73,200	17.0	16.9	Granular, silky spot at circumference	.18*, .16
7237	A 82 2 I B 15	.505	.20	26,000	68,500	15.5	16.9	Granular, silvery luster 80 per cent, silky 20 per cent	.15, .16*
7216	A 83 I B 15	.505	.20	27,000	68,450	21.0	20.5	Granular 70 per cent, silky 30 per cent	.19, .22*
7209	A 81 I B 15	.505	.20	31,000	70,300	21.5	20.5	Granular, silky spot at circumference	.23*, .20
7210	A 85 I B 15	.505	.20	32,000	69,800	20.5	20.5	.....do	.19, .22*
7211	A 86 I B 15	.505	.20	30,000	70,450	15.0	16.9	.....do	.17*, .13
7238	A 86 2 I B 15	.505	.20	23,000	66,850	19.5	20.5	.....do	.17, .22*
7221	A 87 I B 15	.505	.20	33,000	73,950	16.5	16.9	Granular 80 per cent, silky 20 per cent	.18*, .15
7222	A 88 I B 15	.505	.20	30.000	74,500	14.0	16.9	Granular, silky spot at circumference	.13, .15*
7258	A 88 2 I B 15	.505	.20	34,000	73,550	21.5	23.9	Granular 30 per cent, dull amorphous 70 per cent	.22*, .21
7223	A 89 I B 15	.505	.20	24,000	57,400	21.0	27.4	Silky, trace of granulation	.15, .27*
7259	A 89 2 I B 15	.505	.20	33,000	74,800	16.0	16.9	Granular, silky spot at circumference	.17*, .15
7239	A 90 I B 15	.505	.20	31.000	73,100	17.0	20.5	Granular 85 per cent, silky 15 per cent	.15, .19*
7253	A 91 I B 15	.505	.20	35,000	77,600	12.5	13.2	Granular, silky spot at circumference	.13*, .12
7254	A 92 I B 15	.505	.20	30,000	71,300	20.0	23.9	Granular 60 per cent, silky 40 per cent	.23*, .17
7260	A 93 I B 15	.505	.20	28,000	78,500	12.5	16.9	Granular, silky spot at circumference	.12, .13*
7261	A 94 I B 15	.505	.20	29,000	77,800	15.5	16.9	.....do	.15, .16*
7280	A 95 I B 15	.505	.20	32,000	74,100	16.0	16.9	Granular 80 per cent, silky 20 per cent	.18*, .14

TABULATION—Continued.

INNER BASES OF 15-POUNDER GUN MOUNTS, STEEL CASTINGS—Continued.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		*Inch.*
7281	A 96 I B 15	.505	.20	32,000	73,800	18.5	20.5	Granular 60 per cent, dull silky 40 per cent	.15, .22*
7282	A 97 I B 15	.505	.20	37,000	79,800	18.0	20.5	Granular 60 per cent, silky 40 per cent	.20*, .16
7299	A 98 I B 15	.505	.20	29,000	69,500	14.5	20.5	Granular, silky spot at circumference	.14*, .15
7308	A 99 I B 15	.505	.20	32,000	71,400	15.0	16.9	Granular 80 per cent, dull silky 20 per cent	.14, .16*
7309	A 100 I B 15	.505	.20	35,000	77,000	15.0	16.9	Granular 80 per cent, dull silky 20 per cent	.16*, .14
7310	A 101 I B 15	.505	.20	32,000	74,900	17.0	20.5	Granular 85 per cent, silky 15 per cent	.15, .19*
7311	A 102 I B 15	.505	.20	34,000	76,550	17.5	16.9	Granular 80 per cent, dull silky 20 per cent	.17, .18*
7312	A 103 I B 15	.505	.20	35,000	75,500	13.5	16.9	Granular 60 per cent, dull silky 40 per cent	.12, .15*
7313	A 104 I B 15	.505	.20	29,000	62,850	5.5	9.5	Granular 85 per cent, silky 15 per cent	.05, .06*
7314	A 105 I B 15	.505	.20	31,000	79,050	20.0	23.9	Granular 50 per cent, silky 50 per cent	.17, .23*
7315	A 106 I B 15	.505	.20	28,000	73,400	18.0	20.5	Granular 75 per cent, silky 25 per cent	.19*, .17
7335	A 107 I B 15	.505	.20	30,000	72,950	20.5	23.9	Granular, silky spot at circumference	.21, .20*
7342	A 108 I B 15	.505	.20	33,000	80,100	20.5	23.9	.....do	.20, .21*
7343	A 109 I B 15	.505	.20	40,000	90,600	19.0	20.5	Granular 20 per cent, dull silky 80 per cent	.22*, .16
7344	A 110 I B 15	.505	.20	35,000	80,350	17.0	20.5	Granular, silky spot at circumference	.20*, .14
7345	A 111 I B 15	.505	.20	39,000	91,400	19.0	23.9	.....do	.17, .21*

OUTER BASES—15-POUNDER GUN MOUNTS.

STEEL CASTINGS.

No. 7240.

Marks, $\overset{\text{D 65}}{\text{2 O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00070	.00045	....	....	
21,000	.00075	.00005	....	....	
22,000	.00085	.00010	....	....	Elastic limit.
23,000	.00110	.00025	....	....	
24,000	.00165	.00055	....	....	
25,000	.00245	.00080	....	....	
26,000	.00375	.00130	....	....	
27,000	.00500	.00125	....	....	
28,000	.00610	.00110	....	....	
63,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	63,400
Elastic limit per square inch of original section	do...	22,000
Elongation per inch after rupture	inch..	.2050
Elongation per inch under strain at elastic limit	do...	.00085
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		″.95 from neck
Character of broken surface		dull silky 80 per cent, granular 20 per cent
Elongation of inch sections		″.21*, ″.20

No. 7213.

Marks, $\overset{\text{D 67}}{\text{O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00065	.00035	....	....	
29,000	.00100	.00035	....	....	Elastic limit.
30,000	.00790	.00690	....	....	
31,000	.00865	.00075	....	....	
32,000	.00950	.00085	....	....	
33,000	.01040	.00090	....	....	
34,000	.01150	.00110	....	....	
46,300	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	46,300
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.0500
Elongation per inch under strain at elastic limit	do...	.00100
Reduction in diameter at point of rupture	do...	.005
Reduction in area after rupture, per cent of original section		1.8
Position of rupture		″.20 from neck
Character of broken surface		dull gray amorphous in part, and in part granular; irregular surface
Elongation of inch sections		″.03, ″.07*

No. 7241.

Marks, $\overset{D\ 67}{2\ O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00070	.00040			
25,000	.00090	.00020			
27,000	.00100	.00010			
28,000	.00105	.00005			
29,000	.00115	.00010			Elastic limit.
30,000	.00195	.00080			
31,000	.00250	.00055			
32,000	.00340	.00090			
33,000	.00450	.00110			
34,000	.00550	.00100			
67,000					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	67,000
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.1650
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.60 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.18*, ″.15

No. 7214.

Marks, $\overset{D\ 68}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00060	.00030			
30,000	.00105	.00045			Elastic limit.
31,000	.00545	.00440			
32,000	.00840	.00295			
33,000	.00925	.00085			
34,000	.01015	.00090			
35,000	.01095	.00080			
71,500					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	71,500
Elastic limit per square inch of original section	do...	30,000
Elongation per inch after rupture	inch..	.2050
Elongation per inch under strain at elastic limit	do...	.00105
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.9 from neck
Character of broken surface		granular 60 per cent. silky 40 per cent
Elongation of inch sections		″.18, ″.23*

No. 7217.

Marks, $\overset{D\ 69}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00020	.00010	....	....	
20,000	.00060	.00040	....	....	
30,000	.00100	.00040	....	....	
31,000	.00105	.00005	....	....	
32,000	.00110	.00005	....	....	Elastic limit.
33,000	.00800	.00690	....	....	
34,000	.00835	.00035	....	....	
35,000	.00865	.00030	....	....	
36,000	.00955	.00090	....	....	
37,000	.01040	.00085	....	....	
74,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds.. 74,400
Elastic limit per square inch of original section .... do... 32,000
Elongation per inch after rupture .... inch.. .1500
Elongation per inch under strain at elastic limit .... do... .00110
Reduction in diameter at point of rupture .... do... .045
Reduction in area after rupture, per cent of original section 16.9
Position of rupture .... ″.48 from neck
Character of broken surface .... granular 85 per cent, silky 15 per cent
Elongation of inch sections .... ″.17*, ″.18

No. 7218.

Marks, $\overset{D\ 70}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00065	.00035	....	....	
25,000	.00085	.00020	....	....	
27,000	.00095	.00010	....	....	
28,000	.00100	.00005	....	....	Elastic limit.
29,000	.00515	.00415	....	....	
30,000	.00590	.00075	....	....	
31,000	.00660	.00070	....	....	
32,000	.00750	.00090	....	....	
33,000	.00875	.00125	....	....	
34,000	.00935	.00060	....	....	
71,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds.. 71,500
Elastic limit per square inch of original section .... do... 28,000
Elongation per inch after rupture .... inch.. .1100
Elongation per inch under strain at elastic limit .... do... .00100
Reduction in diameter at point of rupture .... do... .035
Reduction in area after rupture, per cent of original section 13.2
Position of rupture .... ″.54 from neck
Character of broken surface .... granular 85 per cent, silky 15 per cent
Elongation of inch sections .... ″.12*, ″.10

No. 7269.

Marks, $\overset{D\ 70}{2\ O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00075	.00040	....	....	
30,000	.00110	.00035	....	....	Elastic limit.
31,000	.00130	.00020	....	....	
32,000	.00150	.00020	....	....	
33,000	.00750	.00600	....	....	
34,000	.00815	.00065	....	....	
35,000	.00900	.00085	....	....	
76,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	76,500
Elastic limit per square inch of original section ....do...	30,000
Elongation per inch after rupture ....inch..	.1700
Elongation per inch under strain at elastic limit ....do...	.00110
Reduction in diameter at point of rupture ....do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	″.95 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	″.16, ″.18

No. 7219.

Marks, $\overset{D\ 71}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00060	.00030	....	....	
25,000	.00085	.00025	....	....	
29,000	.00100	.00015	....	....	
30,000	.00105	.00005	....	....	Elastic limit.
31,000	.00460	.00355	....	....	
32,000	.00680	.00220	....	....	
33,000	.00740	.00060	....	....	
34,000	.00800	.00060	....	....	
35,000	.00900	.00100	....	....	
73,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	73,450
Elastic limit per square inch of original section ....do...	30,000
Elongation per inch after rupture ....inch..	.1500
Elongation per inch under strain at elastic limit ....do...	.00105
Reduction in diameter at point of rupture ....do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	″.92 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	″.16, ″.14

No. 7220.

Marks, $\substack{\text{D 72}\\ \text{O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
20,000	.00070	.00035			
25,000	.00100	.00030			
27,000	.00110	.00010			
28,000	.00115	.00005			Elastic limit.
29,000	.00650	.00535			
30,000	.00725	.00075			
31,000	.00775	.00050			
32,000	.00825	.00050			
33,000	.00900	.00075			
72,000					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	72,000
Elastic limit per square inch of original section ....do...	28,000
Elongation per inch after rupture ....inch..	.1700
Elongation per inch under strain at elastic limit ....do...	.00115
Reduction in diameter at point of rupture ....do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	″.90 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	″.17*, ″.17

No. 7242.

Marks, $\substack{\text{D 73}\\ \text{O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015			
20,000	.00060	.00035			
25,000	.00085	.00025			
28,000	.00095	.00010			
29,000	.00100	.00005			Elastic limit.
30,000	.00675	.00575			
31,000	.00750	.00075			
32,000	.00825	.00075			
33,000	.00910	.00085			
34,000	.01000	.00090			
69,450					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	69,450
Elastic limit per square inch of original section ....do...	29,000
Elongation per inch after rupture ....inch..	.1300
Elongation per inch under strain at elastic limit ....do...	.00100
Reduction in diameter at point of rupture ....do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	1″.14 from neck
Character of broken surface	granular 50 per cent, silky 50 per cent
Elongation of inch sections	″.13*, ″.13

No. 7243.

Marks, $\overset{\text{D 74}}{\text{O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015			
20,000	.00060	.00035			
25,000	.00085	.00025			
27,000	.00095	.00010			
28,000	.00100	.00005			
29,000	.00110	.00010			Elastic limit.
30,000	.00235	.00125			
31,000	.00475	.00240			
32,000	.00570	.00095			
33,000	.00640	.00070			
34,000	.00715	.00075			
77,500					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	77,500
Elastic limit per square inch of original section ....do...	29,000
Elongation per inch after rupture ....inch..	.1550
Elongation per inch under strain at elastic limit ....do...	.00110
Reduction in diameter at point of rupture ....do...	.05
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	".66 from neck
Character of broken surface	granular, silky spot at circumference
Elongation of inch sections	".16*, ".15

No. 7244.

Marks, $\overset{\text{D 75}}{\text{O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00005	.00005	0.	0.	
10,000	.00015	.00010			
20,000	.00055	.00040			
30,000	.00100	.00045			
32,000	.00105	.00005			Elastic limit.
33,000	.00450	.00345			
34,000	.00600	.00150			
35,000	.00650	.00050			
36,000	.00700	.00050			
37,000	.00775	.00075			
80,600					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	80,600
Elastic limit per square inch of original section ....do...	32,000
Elongation per inch after rupture ....inch..	.160
Elongation per inch under strain at elastic limit ....do...	.00105
Reduction in diameter at point of rupture ....do...	.045
Reduction in area after rupture, per cent of original section	16.9
Position of rupture	".48 from neck
Character of broken surface	granular 85 per cent, silky 15 per cent
Elongation of inch sections	".14, ".18

No. 7245.

Marks, $\overset{\text{D 76}}{\text{O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00055	.00030	....	....	
25,000	.00075	.00020	....	....	
28,000	.00090	.00015	....	....	
29,000	.00095	.00005	....	....	Elastic limit.
30,000	.00500	.00405	....	....	
31,000	.00590	.00090	....	....	
32,000	.00660	.00070	....	....	
33,000	.00725	.00065	....	....	
34,000	.00810	.00085	....	....	
71,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	71,400
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.0800
Elongation per inch under strain at elastic limit	do...	.00095
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		".54 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		".07, ".09*

No. 7270.

Marks, $\overset{\text{D 76}}{\text{2 O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
30,000	.00105	.00040	....	....	
32,000	.00110	.00005	....	....	Elastic limit.
33,000	.00130	.00020	....	....	
34,000	.00150	.00020	....	....	
35,000	.01040	.00890	....	....	
36,000	.01145	.00105	....	....	
37,000	.01200	.00055	....	....	
72,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,000
Elastic limit per square inch of original section	do...	32,000
Elongation per inch after rupture	inch..	.1850
Elongation per inch under strain at elastic limit	do...	.00110
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		".75 from neck
Character of broken surface		granular 60 per cent, silky 40 per cent
Elongation of inch sections		".20*, ".17

No. 7247.

Marks, $\overset{D\ 77}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00065	.00035	....	....	
30,000	.00105	.00040	....	....	
33,000	.00115	.00010	....	....	
34,000	.00120	.00005	....	....	Elastic limit.
35,000	.00650	.00530	....	....	
36,000	.00700	.00050	....	....	
37,000	.00775	.00075	....	....	
38,000	.00850	.00075	....	....	
39,000	.00925	.00075	....	....	
78,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 78,6
Elastic limit per square inch of original section ....do... 34,00
Elongation per inch after rupture ....inch.. .14
Elongation per inch under strain at elastic limit ....do... .001
Reduction in diameter at point of rupture................................do... .05
Reduction in area after rupture, per cent of original section................................ 30.
Position of rupture .... ″.30 from nec
Character of broken surface................................ silky 60 per cent, granular 40 per ce
Elongation of inch sections................................ ″.11, ″.1

No. 7248.

Marks, $\overset{D\ 78}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00070	.00040	....	....	
25,000	.00090	.00020	....	....	
28,000	.00105	.00015	....	....	
29,000	.00110	.00005	....	....	Elastic limit.
30,000	.00555	.00445	....	....	
31,000	.00620	.00065	....	....	
32,000	.00700	.00080	....	....	
33,000	.00770	.00070	....	....	
34,000	.00845	.00075	....	....	
73,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 73,40
Elastic limit per square inch of original section ....do... 29,00
Elongation per inch after rupture ....inch.. .14
Elongation per inch under strain at elastic limit ....do... .0011
Reduction in diameter at point of rupture................................do... .04
Reduction in area after rupture, per cent of original section................................ 16.9
Position of rupture .... ″.55 from neck
Character of broken surface................................ granular 85 per cent, silky 15 per cent
Elongation of inch sections................................ ″.15*, ″.13

No. 7275.

Marks, $\overset{\text{D 79}}{\text{O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00060	.00030			
30,000	.00105	.00045			
31,000	.00115	.00010			Elastic limit.
32,000	.00150	.00035			
33,000	.00815	.00665			
34,000	.00855	.00040			
35,000	.00930	.00075			
36,000	.01025	.00095			
72,600					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,600
Elastic limit per square inch of original section	do...	31,000
Elongation per inch after rupture	inch..	.1400
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.7 from neck
Character of broken surface		granular 60 per cent, silky 40 per cent
Elongation of inch sections		″.13, ″.15*

No. 7288.

Marks, $\overset{\text{D 80}}{\text{O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
20,000	.00060	.00025			
30,000	.00100	.00040			
36,000	.00120	.00020			
37,000	.00130	.00010			Elastic limit.
38,000	.00710	.00580			
39,000	.00750	.00040			
40,000	.00845	.00095			
41,000	.00895	.00050			
42,000	.00975	.00080			
85,100					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,100
Elastic limit per square inch of original section	do...	37,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00130
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.6 from neck
Character of broken surface		granular 70 per cent, silky 30 per cent
Elongation of inch sections		″.16*, ″.14

No. 7289.

Marks, $\overset{\text{D 81}}{\text{O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00005	.00005	0.	0.	
10,000	.00025	.00020			
20,000	.00055	.00030	....	....	
30,000	.00095	.00040	....	....	
38,000	.00120	.00025	....	....	Elastic limit.
39,000	.00730	.00610	....	....	
40,000	.00850	.00120	....	....	
41,000	.00900	.00050	....	....	
42,000	.01000	.00100	....	....	
43,000	.01075	.00075	....	....	
83,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	83,90
Elastic limit per square inch of original section	do...	38,00
Elongation per inch after rupture	inch..	.16
Elongation per inch under strain at elastic limit	do...	.001
Reduction in diameter at point of rupture	do...	.0
Reduction in area after rupture, per cent of original section		2
Position of rupture		".75 from neck
Character of broken surface		granular 70 per cent, silky 30 per cent
Elongation of inch sections		".15, ".1

No. 7290.

Marks, $\overset{\text{D 82}}{\text{O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
36,000	.00120	.00020	....	....	Elastic limit.
37,000	.00710	.00590	....	....	
38,000	.00800	.00090	....	....	
39,000	.00890	.00090	....	....	
40,000	.00925	.00035	....	....	
41,000	.01020	.00095	....	....	
81,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds..	81,5
Elastic limit, per square inch of original section	do...	36,00
Elongation per inch after rupture	inch..	.15
Elongation per inch under strain at elastic limit	do...	.00
Reduction in diameter at point of rupture	do...	.04
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		1" from neck
Character of broken surface		granular 70 per cent, silky 30 per cent
Elongation of inch sections		".17*, ".1

No. 7307.

Marks, $\overset{D\ 83}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00025	.00010	....	....	
20,000	.00065	.00040	....	....	
30,000	.00105	.00040	....	....	
35,000	.00125	.00020	....	....	
36,000	.00130	.00005	....	....	Elastic limit.
37,000	.00815	.00685	....	....	
38,000	.00880	.00065	....	....	
39,000	.00950	.00070	....	....	
40,000	.01040	.00090	....	....	
41,000	.01125	.00085	....	....	
79,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79,000
Elastic limit per square inch of original section	do...	36,000
Elongation per inch after rupture	inch..	.1400
Elongation per inch under strain of elastic limit	do...	.00130
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per centum of original section		16.9
Position of rupture		″.65 from neck
Character of broken surface		granular 80 per cent, dull silky 20 per cent
Elongation of inch sections		″.15*, ″.13

No. 7332.

Marks, $\overset{D\ 84}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015	....	....	
20,000	.00065	.00040	....	....	
30,000	.00105	.00040	....	....	
31,000	.00110	.00005	....	....	
32,000	.00115	.00005	....	....	Elastic limit.
33,000	.00200	.00085	....	....	
34,000	.00400	.00200	....	....	
35,000	.00525	.00125	....	....	
36,000	.00600	.00075	....	....	
37,000	.00660	.00060	....	....	
80,350	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,350
Elastic limit per square inch of original section	do...	32,000
Elongation per inch after rupture	inch..	.075
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		″.95 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.07, ″.08*

No. 7333.

Marks, $\overset{D\ 85}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00035	.00020	....	....	
20,000	.00070	.00035	....	....	
25,000	.00090	.00020	....	....	
28,000	.00100	.00010	....	....	
29,000	.00105	.00005	....	....	Elastic limit.
30,000	.00230	.00125	....	....	
31,000	.00575	.00345	....	....	
32,000	.00650	.00075	....	....	
33,000	.00725	.00075	....	....	
34,000	.00800	.00075	....	....	
74,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	74,900
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.00105
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.18 from neck
Character of broken surface		granular 85 per cent, silky 15 per cent
Elongation of inch sections		″.16* ″.14

No. 7334.

Marks, $\overset{D\ 86}{O\ B\ 15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00015	.00015	0.	0.	
10,000	.00030	.00015	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
34,000	.00125	.00025	....	....	
35,000	.00130	.00005	....	....	Elastic limit.
36,000	.01080	.00950	....	....	
37,000	.01125	.00045	....	....	
38,000	.01200	.00075	....	....	
39,000	.01310	.00110	....	....	
40,000	.01400	.00090	....	....	
72,500	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,500
Elastic limit per square inch of original section	do...	35,000
Elongation per inch after rupture	inch..	.2050
Elongation per inch under strain at elastic limit	do...	.00130
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″.12 from neck
Character of broken surface		granular 40 per cent, silky 60 per cent
Elongation of inch sections		″.20*, ″.21

No. 7340.

Marks, $\overset{\text{D 87}}{\text{O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00040	.00030	....	....	
20,000	.00085	.00045	....	....	
25,000	.00115	.00030	....	....	Elastic limit.
26,000	.00140	.00025	....	....	
27,000	.00260	.00120	....	....	
28,000	.00400	.00140	....	....	
29,000	.00600	.00200	....	....	
30,000	.00710	.00110	....	....	
66,850	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	66,850
Elastic limit per square inch of original section	do...	25,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.00115
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″.10 from neck
Character of broken surface		granular, silky spot at circumference
Elongation of inch sections		″.22, ″.22*

No. 7320.

Marks, $\overset{\text{D 88}}{\text{O B 15}}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	....	....	
10,000	.00025	.00015	....	....	
20,000	.00065	.00040	....	....	
30,000	.00105	.00040	....	....	
31,000	.00110	.00005	....	....	Elastic limit.
32,000	.00125	.00015	....	....	
33,000	.00550	.00425	....	....	
34,000	.00600	.00050	....	....	
35,000	.00680	.00080	....	....	
36,000	.00760	.00080	....	....	
37,000	.00825	.00065	....	....	
77,450	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	77,450
Elastic limit per square inch of original section	do...	31,000
Elongation per inch after rupture	inch..	.1850
Elongation per inch under strain at elastic limit	do...	.00110
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″ from neck
Character of broken surface		granular 80 per cent, silky 20 per cent
Elongation of inch sections		″.20*, ″.17

No. 7328.

Marks, $\overset{\text{D 89}}{\text{O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015			
20,000	.00055	.00030			
30,000	.00095	.00040			
35,000	.00110	.00015			
37,000	.00120	.00010			
38,000	.00125	.00005			Elastic limit.
39,000	.00865	.00740			
40,000	.00930	.00065			
41,000	.01010	.00080			
42,000	.01100	.00090			
43,000	.01180	.00080			
81,500					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 81,500
Elastic limit per square inch of original section ....do... 38,000
Elongation per inch after rupture ....inch.. .165
Elongation per inch under strain at elastic limit ....do... .00125
Reduction in diameter at point of rupture ....do... .045
Reduction in area after rupture, per cent of original section 16.9
Position of rupture .... ".82 from neck
Character of broken surface .... granular, silky spot at circumference
Elongation of inch sections .... ".16*, ".17

No. 7329.

Marks, $\overset{\text{D 90}}{\text{O B 15}}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00025	.00015			
20,000	.00060	.00035			
30,000	.00095	.00035			
35,000	.00115	.00020			
36,000	.00120	.00005			
37,000	.00125	.00005			Elastic limit.
38,000	.00970	.00845			
39,000	.01020	.00050			
40,000	.01105	.00085			
41,000	.01175	.00070			
42,000	01260	.00085			
77,450					Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds.. 77,450
Elastic limit per square inch of original section ....do... 37,000
Elongation per inch after rupture ....inch.. .1750
Elongation per inch under strain at elastic limit ....do... .00125
Reduction in diameter at point of rupture ....do... .045
Reduction in area after rupture, per cent of original section 16.9
Position of rupture .... ".98 from neck
Character of broken surface .... granular 80 per cent, silky 20 per cent
Elongation of inch sections .... ".18*, ".17

No. 7330.

Marks, $\overset{D\ 91}{O\ B\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00065	.00035			
30,000	.00105	.00040			
31,000	.00110	.00005			
32,000	.00115	.00005			Elastic limit.
33,000	.00930	.00815			
34,000	.00990	.00060			
35,000	.01085	.00095			
36,000	.01195	.00110			
37,000	.01275	.00080			
70,450					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds.. 70,450
Elastic limit per square inch of original section	do... 32,000
Elongation per inch after rupture	inch.. .1900
Elongation per inch under strain at elastic limit	do... .00115
Reduction in diameter at point of rupture	do... .055
Reduction in area after rupture, per cent of original section	20.5
Position of rupture	1".10 from neck
Character of broken surface	granular 60 per cent, silky 40 per cent
Elongation of inch sections	".19*, ".19

No. 7341.

Marks, $\overset{D\ 92}{O\ B\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
20,000	.00070	.00035			
30,000	.00105	.00035			
39,000	.00150	.00045			Elastic limit.
40,000	.01025	.00875			
41,000	.01125	.00100			
42,000	.01215	.00090			
43,000	.01300	.00085			
44,000	.01400	.00100			
79,900					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds.. 79,900
Elastic limit per square inch of original section	do... 39,000
Elongation per inch after rupture	inch.. .2250
Elongation per inch under strain at elastic limit	do... .00150
Reduction in diameter at point of rupture	do... .075
Reduction in area after rupture, per cent of original section	27.4
Position of rupture	1" from neck
Character of broken surface	granular 40 per cent, silky 60 per cent
Elongation of inch sections	".24*, ".21

No. 7358.

Marks, $\overset{D\ 93}{O\ B\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
30,000	.00105	.00040	....	....	
35,000	.00120	.00015	....	....	Elastic limit.
36,000	.01010	.00890	....	....	
37,000	.01100	.00090	....	....	
38,000	.01150	.00050	....	....	
39,000	.01250	.00100	....	....	
40,000	.01355	.00105	....	....	
73,900	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................pounds..	73,90
Elastic limit per square inch of original section....................do...	35,00
Elongation per inch after rupture....................inch..	.250
Elongation per inch under strain at elastic limit....................do...	.0013
Reduction in diameter at point of rupture....................do...	.0
Reduction in area after rupture, per cent of original section....................	36.
Position of rupture....................	".85 from nec
Character of broken surface....................fine granular 80 per cent, silky 70 per cent	
Elongation of inch sections....................	".20, ".3

No. 7359.

Marks, $\overset{D\ 94}{O\ B\ 15}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	....	....	
38,000	.00135	.00035	....	....	
39,000	.00140	.00005	....	....	Elastic limit.
40,000	.00600	.00460	....	....	
41,000	.00815	.00215	....	....	
42,000	.00865	.00050	....	....	
43,000	.00950	.00085	....	....	
44,000	.01100	.00150	....	....	
86,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................pounds..	86,00
Elastic limit per square inch of original section....................do...	39,00
Elongation per inch after rupture....................inch..	.140
Elongation per inch under strain at elastic limit....................do...	.00140
Reduction in diameter at point of rupture....................do...	.045
Reduction in area after rupture, per cent of original section....................	16.9
Position of rupture....................	".75 from neck
Character of broken surface....................granular, silky spot at circumference	
Elongation of inch sections....................	".15, ".14

TABULATION.

OUTER BASES OF 15-POUNDER GUN MOUNTS, STEEL CASTINGS.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inches.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		*Inch.*
7240	D 65 2 O B 15	.505	.20	22,000	63,400	20.5	23.9	Granular 20 per cent, dull silky 80 per cent	.21*, .20
7213	D 67 O B 15	.505	.20	29,000	46,300	5.0	1.8	Dull gray amorphous in part and in part granular. Irregular surface	.03, .07*
7241	D 67 2 O B 15	.505	.20	29,000	67,000	16.5	16.9	Granular, silky spot at circumference	.18*, .15
7214	D 68 O B 15	.505	.20	30,000	71,500	20.5	20.5	Granular 60 per cent, silky 40 per cent	.18, .23*
7217	D 69 O B 15	.505	.20	32,000	74,400	15.0	16.9	Granular 85 per cent, silky 15 per cent	.17*, .13
7218	D 70 O B 15	.505	.20	28,000	71,500	11.0	13.2	.....do	.12*, .10
7269	D 70 2 O B 15	.505	.20	30,000	76,500	17.0	16.9	Granular, silky spot at circumference	.16, .18*
7219	D 71 O B 15	.505	.20	30,000	73,450	15.0	16.9	.....do	.16*, .14
7220	D 72 O B 15	.505	.20	28,000	72,000	17.0	16.9	.....do	.17*, .17
7242	D 73 O B 15	.505	.20	29,000	69,450	13.0	16.9	Granular 50 per cent, silky 50 per cent	.13*, .13
7243	D 74 O B 15	.505	.20	29,000	77,500	15.5	16.9	Granular, silky spot at circumference	.16*, .15
7244	D 75 O B 15	.505	.20	32,000	80,600	16.0	16.9	Granular 85 per cent, silky 15 per cent	.14, .18*
7245	D 76 O B 15	.505	.20	29,000	71,400	8.0	9.5	Granular, silky spot at circumference	.07, .09*
7270	D 76 2 O B 15	.505	.20	32,000	72,000	18.5	23.9	Granular 60 per cent, silky 40 per cent	.20*, .17
7247	D 77 O B 15	.505	.20	34,000	78,600	14.0	20.5	Granular 40 per cent, silky 60 per cent	.11, .17*
7248	D 78 O B 15	.505	.20	29,000	73,400	14.0	16.9	Granular 85 per cent, silky 15 per cent	.15*, .13
7275	D 79 O B 15	.505	.20	31,000	72,600	14.0	16.9	Granular 60 per cent, silky 40 per cent	.13, .15*
7288	D 80 O B 15	.505	.20	37,000	85,100	15.0	16.9	Granular 70 per cent, silky 30 per cent	.16*, .14
7289	D 81 O B 15	.505	.20	38,000	83,900	16.5	20.5	.....do	.15, .18*

TABULATION—Continued.

OUTER BASES OF 15-POUNDER GUN MOUNTS, STEEL CASTINGS—Continued.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inches.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		*Inch.*
7290	D 82 O B 15	.505	.20	36,000	81,500	15.5	16.9	Granular 70 per cent, silky 30 per cent	.17*, .14
7307	D 83 O B 15	.505	.20	36,000	79,000	14.0	16.9	Granular 80 per cent, dull silky 20 per cent	.15*, .13
7332	D 84 O B 15	.505	.20	32,000	80,350	7.5	9.5	Granular, silky spot at circumference	.07, .08*
7333	D 85 O B 15	.505	.20	29,000	74,900	15.0	16.9	Granular 85 per cent, silky 15 per cent	.16*, .14
7334	D 86 O B 15	.505	.20	35,000	72,500	20.5	23.9	Granular 40 per cent, silky 60 per cent	.20*, .21
7340	D 87 O B 15	.505	.20	25,000	66,850	22.0	23.9	Granular, silky spot at circumference	.22, .22*
7320	D 88 O B 15	.505	.20	31,000	77,450	18.5	23.9	Granular 80 per cent, silky 20 per cent	.20*, .17
7328	D 89 O B 15	.505	.20	38,000	81,500	16.5	16.9	Granular, silky spot at circumference	.16*, .17
7329	D 90 O B 15	.505	.20	37,000	77,450	17.5	16.9	Granular 80 per cent, silky 20 per cent	.18*, .17
7330	D 91 O B 15	.505	.20	32,000	70,450	19.0	20.5	Granular 60 per cent, silky 40 per cent	.19*, .19
7341	D 92 O B 15	.505	.20	39,000	79,900	22.5	27.4	Granular 40 per cent, silky 60 per cent	.24*, .21
7358	D 93 O B 15	.505	.20	35,000	73,900	23.0	30.7	Granular 30 per cent, silky 70 per cent	.20, .26*
7359	D 94 O B 15	.505	.20	39,000	86,000	14.5	16.9	Granular, silky spot at circumference	.15*, .14

CARRIER RINGS, 15-POUNDER GUNS.

STEEL FORGINGS.

No. 7246.

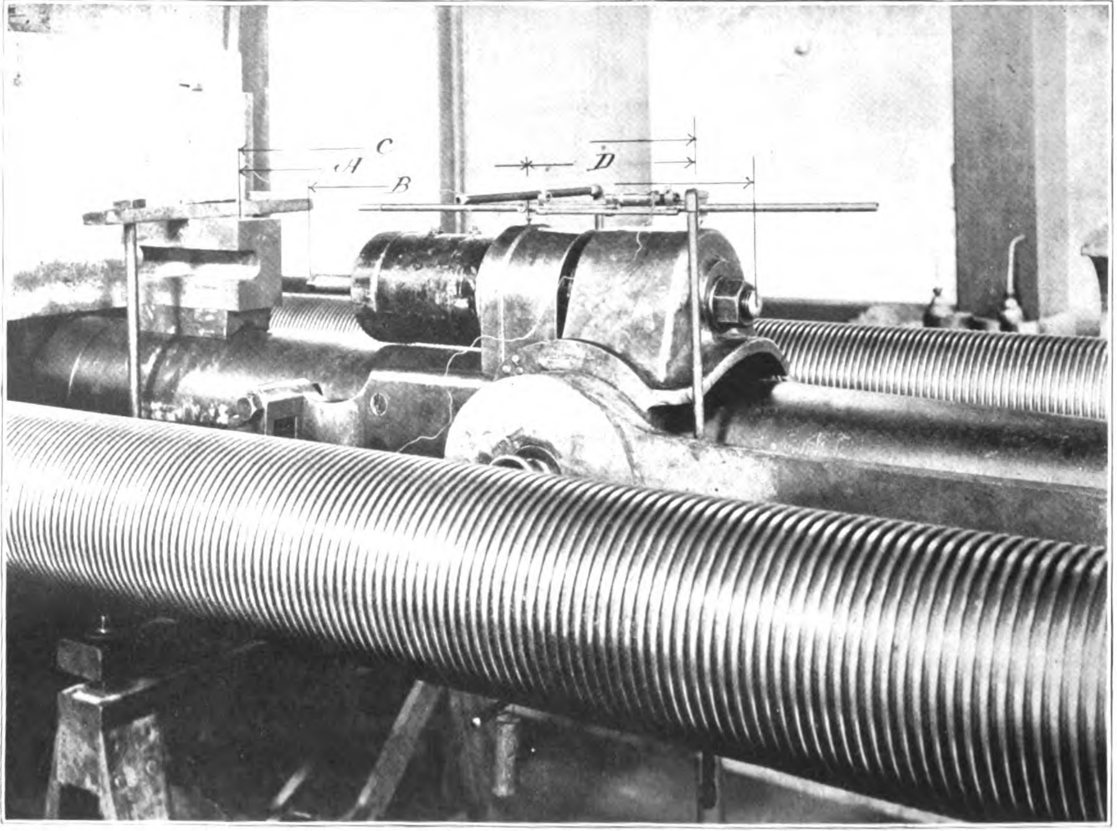
Marks, $^{\text{C R}}_{15}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.*	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00020	.00020	0.	0.	
10,000	.00040	.00020	....	....	
20,000	.00080	.00040	....	....	
30,000	.00115	.00035	....	....	
35,000	.00140	.00025	....	....	
38,000	.00150	.00010	....	....	
39,000	.00155	.00005	....	....	Elastic limit.
40,000	.01310	.01155	....	....	
41,000	.01350	.00040	....	....	
42,000	.01450	.00100	....	....	
43,000	.01600	.00150	....	....	
44,000	.01800	.00200	....	....	
68,500	....	....	....	....	Tensile strength.

General summary.

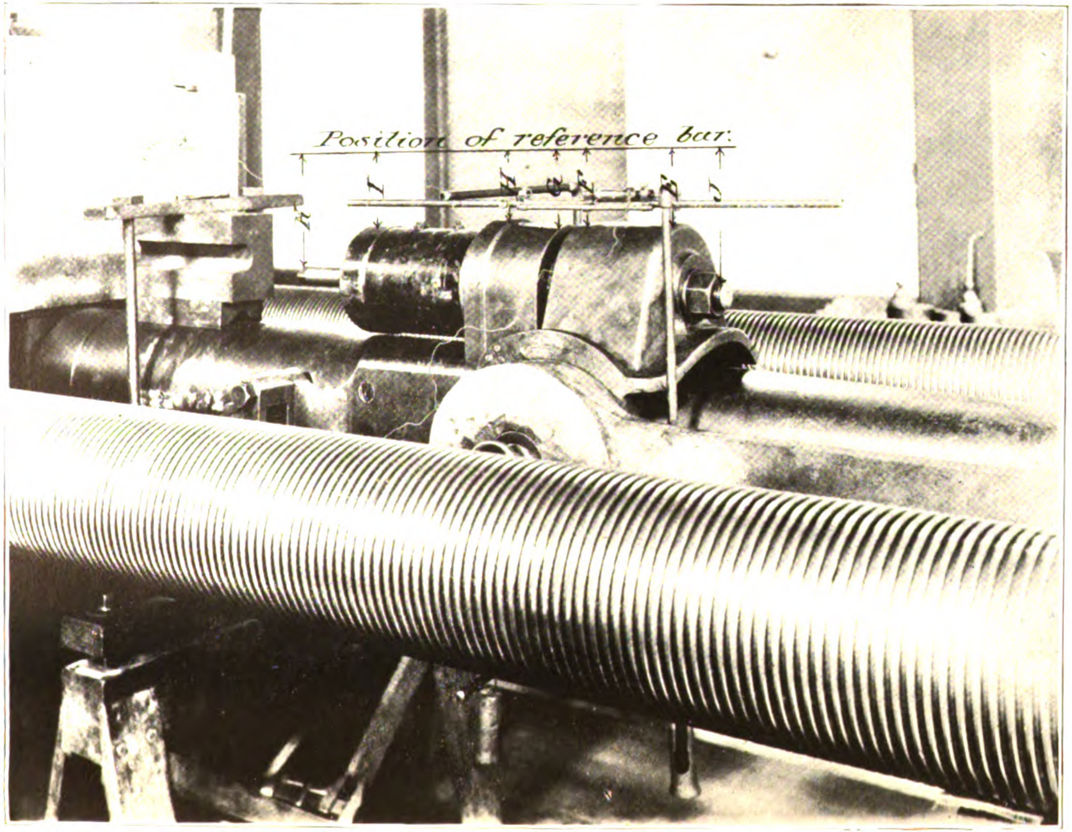
Tensile strength per square inch of original section ....pounds..	68,500
Elastic limit per square inch of original section ....do...	39,000
Elongation per inch after rupture ....inch..	.3350
Elongation per inch under strain at elastic limit ....do...	.00155
Reduction in diameter at point of rupture ....do...	.185
Reduction in area after rupture, per cent of original section	59.8
Position of rupture	1″.18 from neck
Character of broken surface	silky, cup shaped
Elongation of inch sections	″.22, ″.45*

RECOIL MECHANISM OF DRIGGS-SEABURY 15-POUNDER GUN NO. 12.



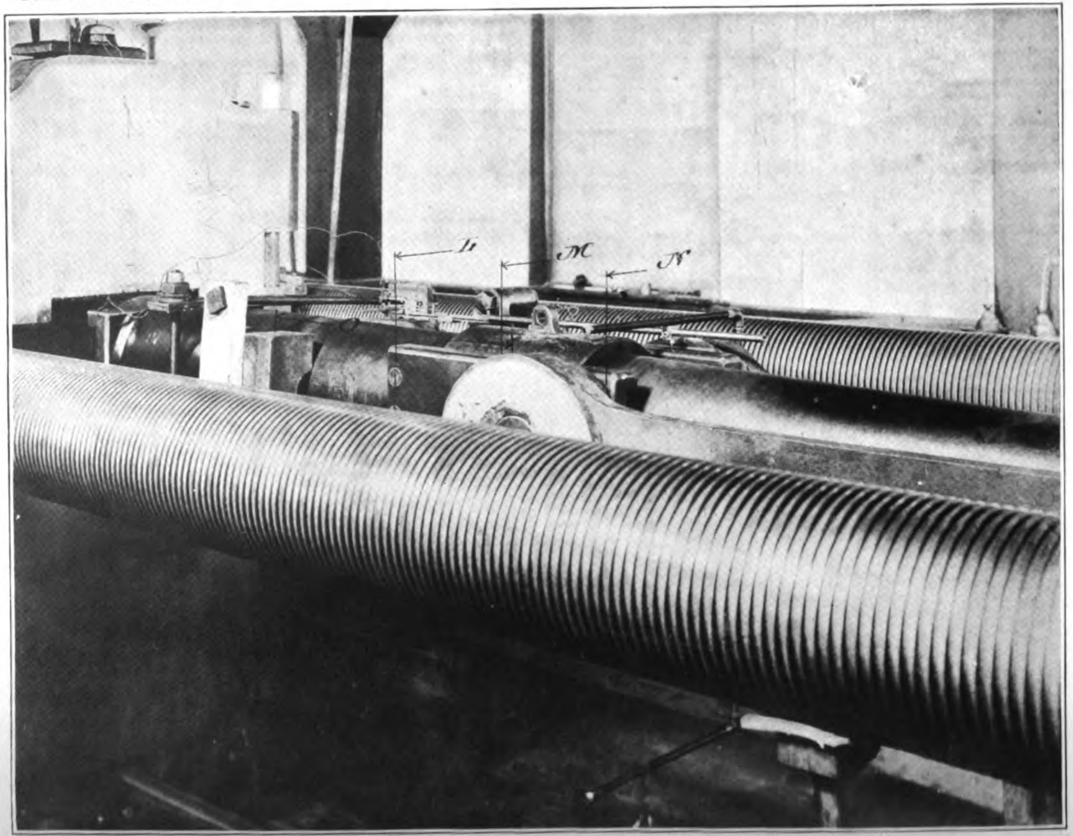
TEST OF THE RECOIL MECHANISM OF DRIGGS SEABURY 15-POUNDER GUN NO. 12.

Photograph No. 1, showing position of gauged lengths A, B, C, and D.



TEST OF THE RECOIL MECHANISM OF DRIGGS-SEABURY 15 POUNDER GUN NO. 12.

Photograph No. 2, showing position of gauged lengths E to K.



TEST OF THE RECOIL MECHANISM OF DRIGGS-SEABURY 15-POUNDER GUN NO. 12.

Photograph No. 8, showing position of gauged lengths L, M, and N.

RECOIL MECHANISM OF DRIGGS-SEABURY 15-POUNDER GUN NO. 12.

The attachments used in making the tests consisted of two eyebars engaging the trunnions, a breech plug with a 3-inch stem extending beyond the breech of the gun, and three filling pieces fitted to the bore of the recoil cylinder. These were secured to the testing machine by gripping the eyebars at points beyond the muzzle of the gun, while at the other end the stem of the breech plug was gripped in the opposite hydraulic jaws of the machine. The springs in the recoil cylinder were removed and three special filling pieces were substituted therefor. When the gun was tested in firing position all three filling pieces were used; in recoil position only one piece was in place in the cylinder.

Tensile stresses were applied in an axial direction to the gun by pulling on the attachments, the reaction being taken up by the recoil mechanism.

Photographs show the gun in the testing machine, and on these prints are sketched the location of the gauged lengths on which observations were made.

The tests began with a series of loadings up to 40,000 pounds, after which the loads were increased to a maximum of 60,000 pounds, the gun being in firing position at the time. These loadings were followed by observations made with the gun in recoil position.

In the first test, the gun being in firing position as regards the relative positions of the oscillating slide and the sleeve, but bottom side up on account of gaining access to the parts under examination, the observations on gauged length A were made upon the longitudinal movement of the gun with reference to a point on the bottom of the lug of the sleeve at its rear end. As shown by the details, the movement of this part of the sleeve lug was ".0235 under a load of 40,000 pounds tension.

These measurements on gauged length A were followed by measurements of the extension of the piston rod, measured over all on gauged length B. Measurements on other gauged lengths followed in the order in which they appear in the details of the tests.

Photograph No. 1 shows the extensometer in position on gauged length D. On gauged points E to K the micrometer employed was secured to a bar mounted over and supported by steel blocks clamped to the gun.

The tabular details show that a movement of point E on the front end of the oscillating slide lug occurred in a direction from the axis of the gun, while at point F, at the rear end of the same lug, the movement was toward the axis of the gun. Similarly, on gauged points G and H the sleeve lug showed an overturning movement, point H moving away from the gun, point G toward it.

After measurements on gauged length K were completed the gun was rotated 180 degrees, and thus brought right side up. Measurements across from cheek to cheek of the oscillating slide at three places—gauged lengths L, M, and N—were now taken. At L and M the cheeks moved outward when loads were applied, whereas at N the movement was toward the gun, the slides closing inward. Longitudinal movements were observed on gauged lengths O and P, representing the movements at points on the slide directly over each trunnion. Up to this time the loads had not been above 40,000 pounds.

Now they were increased to a maximum of 60,000 pounds, and observations continued, returning over the same gauged lengths as before used, the gun remaining in firing position as before. When gauged length O was reached, observations were made on descending loads, in addition to the measurements taken under increments of ascending stresses, and frequently thereafter readings were taken under both directions of loading. It was shown that the movements of the several places on the recoil mechanism did not follow the same paths under ascending and descending stresses. Taking for example the gauge readings on length O, it will be seen that under ascending stresses, for equal increments of load, there were fairly proportional movements of the slide, but when the loads were diminished there was a marked lag in the recovery of the slide. Increasing the load from 50,000 to 60,000 pounds, there was an increase in the total movement of "0.0141, but upon return to 50,000 pounds the recovery of the slide was only "0.0003, this lag in recovery continuing throughout the time of unloading. This behavior is attributed to frictional resistance between the moving parts of the mechanism.

Movements over the ends of the piston rod, gauged length B, showed the same peculiar behavior as above described, pertaining to the oscillating slide. Measurements on the several gauged lengths, taken when the gun was in recoil position, showed the total and relative movements of the parts are modified according to the position of the gun. This lag in recovery is apparently not materially changed by the duration of time. Observations on gauged length D, under descending loads, in which the reduced loads are left acting for intervals of five to ten minutes, showed the recovery in total movement remained practically unchanged after the first readings were taken, until the total load had been reduced to about 22,000 pounds, when evidence appeared of increased recovery after the lapse of a short interval of time.

The test of the gun and recoil mechanism was followed by a free test of the piston, loaded over the same part of its length as when tested in the cylinder. In this free test it was found that the piston rod elongated the same amount, "0.0172, namely, under 42,800 pounds tension that it did in cylinder with the gun in recoil position, under a load of 60,000 pounds on the assembled mechanism. Deducting the initial load of 1,000 pounds in each case, and it appears that 41,800 pounds tension on the free piston rod caused the same elongation of the metal as a load of 59,000 pounds tension on the recoil mechanism, a difference of 17,200 pounds to be accounted for by the frictional resistance of the mechanism. It will be further observed that in the free test of the piston the elongation of the metal was the same under ascending and descending loads, no lag in resilience being displayed in this test.

The gun was returned to the testing machine for supplementary observations, which consisted of determining the resistance of moving the gun in the slides from firing to recoil position, and returning to firing position, the spring now being in place in the recoil cylinder. Finally, the trunnion movements were determined, measuring from fixed blocks clamped to the gun to points on the trunnions. On the right trunnion the micrometer was attached to the trunnion at its center; on the left trunnion the micrometer was attached to the smaller projecting hub.

Diagrams 1 to 5 graphically show certain of the movements observed.

No. 10279.

GUN IN FIRING POSITION.

On gauged length A, from bottom of sleeve at rear end of lug to fixed block on gun.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	
3,000	.0010	....	
5,000	.0021	.0007	
7,000	.0034	.0008	
10,000	.0051	.0009	
12,000	.0064	.0009	
15,000	.0083	.0010	
17,000	.0093	.0010	
20,000	.0112	.0010	
22,000	.0125	.0010	
25,000	.0141	.0010	
27,000	.0154	.0010	
30,000	.0172	.0011	
32,000	.0184	....	
35,000	.0202	.0011	
37,000	.0215	....	
40,000	.0235	.0011	

On gauged length B, over ends of piston rod:

1,000	0.	....	
5,000	.0006	....	
10,000	.0022	....	
20,000	.0041	....	

[Change in extremity of gauged length.]

30,000	.0005	−.0070	
40,000	.0036	−.0070	
40,000	.0036	−.0070	

On gauged length C, from bottom of oscillating slide, front end of lug, to fixed block on gun:

1,000	0.	....	
10,000	.0038	....	
20,000	.0093	....	
30,000	.0149	....	
40,000	.0205	0.	

On gauged length D (difference of A and C), from bottom of sleeve, rear end of lug, to front end of lug on oscillating slide:

1,000	0.	....	
10,000	.0002	....	
20,000	.0000	....	
30,000	−.0005	....	
40,000	−.0009	−.0001	

On gauged point E, over front end of lug of oscillating slide.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	....	Shows a movement of gauged point from the axis of the gun.
10,000	.0037	....	
20,000	.0073	....	
30,000	.0107	....	
40,000	.0136	.0005	
40.000	.0137	.0004	

On gauged point F, over rear end of lug of oscillating slide.

1,000	0.	....	Shows a movement of the gauged point toward the axis of the gun.
10,000	−.0021	....	
20,000	−.0040	....	
30,000	−.0056	....	
40,000	−.0072	−.0002	

On gauged point G, over front end of lug of sleeve.

1,000	0.	....	Shows a movement of the gauged point toward the axis of the gun.
10,000	−.0010	....	
20,000	−.0024	....	
30,000	−.0036	....	
40,000	−.0048	0.	

On gauged point H, over rear end of lug of sleeve.

1,000	0.	....	Shows a movement of the gauged point from the axis of the gun.
10,000	.0018	....	
20,000	.0037	....	
30,000	.0055	....	
40,000	.0073	0.	

On gauged point I, over rear end of cylinder.

1,000	0.	....	
10,000	.0054	....	
20,000	.0106	....	
30,000	.0160	....	
40,000	.0218	—.0002	

On gauged point J, over front end of piston rod.

1,000	0.	....	Shows a movement of the gauged point from the axis of the gun.
10,000	.0055	....	
20,000	.0115	....	
30,000	.0161	....	
40,000	.0215	—.0002	

On gauged point K, over rear end of piston rod.

1,000	0.	....	Shows a movement of the gauged point from the axis of the gun.
10,000	.0063	....	
20,000	.0107	....	
30,000	.0155	....	
40,000	.0220	—.0006	
40,000	.0225	—.0005	Repeated.

Gun rotated so as to be right side up.

On gauged length L, across top of oscillating slide at rear end.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	....	
10,000	.0378	....	
20,000	.0540	....	
30,000	.0636	....	
40,000	.0685	—.0020	
40,000	.0682	—.0013	

On gauged length M, across top of oscillating slide midway of slide.

1,000	0.	....	
10,000	.0022	....	
20,000	.0280	....	
30,000	.0348	....	
40,000	.0399	....	
10,000	.0183	.0007	Repeated.

On transverse gauged length N, across front of oscillating slide.

1,000	0.	....	Shows a movement of gauged points toward each other, slides closing in.
10,000	.0009	....	
20,000	.0014	....	
30,000	.0015	....	
40,000	.0016	—.0002	

On longitudinal gauged length O, from right cheek, abreast the trunnion, of oscillating slide, to fixed block on gun.

1,000	0.	....	
10,000	.0128	....	
20,000	.0282	....	
30,000	.0439	....	
40,000	.0585	.0016	
40,000	.0603	.0014	Repeated.
40,000	.0590	.0010	Repeated.

On longitudinal gauged length P, from left side, abreast the trunnion, of the oscillating slide, to fixed block on gun.

1,000	0.	....	
10,000	.0176	....	
20,000	.0339	....	
30,000	.0493	....	
40,000	.0635	.0003	

On gauged length L.

1,000	0.	....	
10,000	.0375	....	
20,000	.0541	....	
30,000	.0642	....	
40,000	.0693	....	
50,000	.0733	.0009	
60,000	.0790	.0013	

On gauged length M.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	....	
10,000	.0189	....	
20,000	.0285	....	
30,000	.0355	....	
40,000	.0409	....	
50,000	.0455	....	
60,000	.0498	.0006	

On gauged length N.

1,000	0.	....	
10,000	—.0011	....	
20,000	—.0016	....	
30,000	—.0017	....	
40,000	—.0018	....	
50,000	—.0018	....	
60,000	—.0007	0.	
50,000	—.0013	....	Repeated.
60,000	—.0007	0.	Repeated.

On gauged length P.

1,000	0.	....	
10,000	.0187	....	
20,000	.0345	....	
30,000	.0488	....	
40,000	.0635	....	
50,000	.0775	....	
60,000	.0914	.0010	

On gauged length O.

1,000	0.	....	
10,000	.0105	....	
20,000	.0255	....	
30,000	.0400	....	
40,000	.0549	....	
50,000	.0694	....	
60,000	.0835	....	
50,000	.0832	....	
40,000	.0827	....	
30,000	.0817	....	
20,000	.0701	....	
10,000	.0370	....	
1,000	.0006	....	
1,000	0.	....	
10,000	.0104	....	
20,000	.0260	....	
30,000	.0399	....	
40,000	.0540	....	
50,000	.0685	....	
60,000	.0827	....	
50,000	.0825	....	
40,000	.0821	....	
30,000	.0810	....	
20,000	.0694	....	
10,000	.0357	....	
1,000	....	—.0015	

Gun rotated, put back into first position, bottom side up.
On point J, over front end of piston rod.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.		
10,000	.0077		
20,000	.0143		
30,000	.0202		
40,000	.0253		
50,000	.0300		
60,000	.0347	.0038	

On point K, over rear end of piston rod.

1,000	0.		
10,000	.0072		
20,000	.0120		
30,000	.0176		
40,000	.0244		
50,000	.0312		
60,000	.0384	—.0014	

On point I, over rear end of cylinder.

1,000	0.		
10,000	.0056		
20,000	.0111		
30,000	.0168		
40,000	.0225		
50,000	.0281		
60,000	.0338	—.0004	

On point H, over rear end of lug of sleeve.

1,000	0.		
10,000	.0018		
20,000	.0034		
30,000	.0055		
40,000	.0073		
50,000	.0091		
60,000	.0110		
50,000	.0110		
40,000	.0109		
30,000	.0108		
20,000	.0090		
10,000	.0049	0.	

On point G, over front end of lug of sleeve.

1,000	0.		
10,000	—.0005		
20,000	—.0008		
30,000	—.0013		
40,000	—.0021		
50,000	—.0026		
60,000	—.0030	0.	

On point F, over rear end of lug of oscillating slide.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	....	
10,000	—.0009	....	
20,000	—.0027	....	
30,000	—.0070	....	
40,000	—.0091	....	
50,000	—.0112	....	
60,000	—.0134	0.	

On point E, over front end of lug of oscillating slide.

1,000	0.	....	
10,000	.0042	....	
20,000	.0078	....	
30,000	.0114	....	
40,000	.0145	....	
50,000	.0174	....	
60,000	.0203	....	
50,000	.0200	....	
40,000	.0197	....	
30,000	.0192	....	
20,000	.0171	....	
10,000	.0099	.0003	

On gauged length D (difference of A and C).

1,000	0.	....	
10,000	—.0002	....	
20,000	—.0006	....	
30,000	—.0014	....	
40,000	—.0021	....	
50,000	—.0026	....	
60,000	—.0031	—.0006	

On gauged length C, from bottom of oscillating slide, front end of lug, to fixed block on gun.

1,000	0.	....	
10,000	.0038	....	
20,000	.0088	....	
30,000	.0142	....	
40,000	.0191	....	
50,000	.0245	....	
60,000	.0293	....	
50,000	.0294	....	
40,000	.0295	....	
30,000	.0296	....	
20,000	.0249	....	
10,000	.0130	.0004	

On gauged length A, from bottom of sleeve, rear end of lug, to fixed block on gun.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	....	
10,000	.0037	....	
20,000	.0091	....	
30,000	.0150	....	
40,000	.0216	....	
50,000	.0267	....	
60,000	.0325	....	
50,000	.0326	....	
40,000	.0326	....	
30,000	.0327	....	
20,000	.0275	....	
10,000	.0143	.0003	

On gauged length B, over ends of piston rod.

1,000	0.	....	
10,000	.0023	....	
20,000	.0046	....	
30,000	.0074	....	
40,000	.0099	....	
50,000	.0128	....	
60,000	.0158	....	
50,000	.0157	....	
40,000	.0155	....	
30,000	.0154	....	
20,000	.0125	....	
10,000	.0060	0.	
60,000	.0158	0.	

GUN IN RECOIL POSITION, RIGHT SIDE UP.

On gauged length L, across top of oscillating slide, rear end.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inches.*	*Inches.*	
1,000	0.	....	
10,000	.0071	....	
20,000	.0087	....	
30,000	.0091	....	+ readings indicate outward movement.
40,000	.0073	....	
50,000	.0047	....	
60,000	.0015	....	
50,000	−.0025	....	
40,000	−.0105	....	− readings indicate inward movement.
30,000	−.0246	....	
20,000	−.0225	....	
10,000	−.0172	−.0091	
Micrometer reset.			
1,000	0.	....	
10,000	.0045	....	
20,000	.0071	....	
30,000	.0086	....	
40,000	.0094	....	
50,000	.0093	....	
60,000	.0084	....	
60,000	.0082	....	After 1 minute.
50,000	.0045	....	
40,000	−.0084	....	
30,000	−.0157	....	
20,000	−.0143	....	
10,000	−.0094	−.0018	

On gauged length N, across front of oscillating slide.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
1,000	.0	....	
10,000	.0139	....	
20,000	.0261	....	
30,000	.0370	....	
40,000	.0472	....	
50,000	.0568	....	
60,000	.0661	....	Closes inward.
60,000	.0666	....	Reading taken after 1 minute.
50,000	.0614	....	
40,000	.0536	....	
30,000	.0395	....	
20,000	.0278	....	
10,000	.0154	.0017	
60,000	....	.0017	
60,000	....	.0007	
60,000	....	.0007	
60,000	.0652	.0005	
60,000	.0656	.0014	
60,000	.0658	.0013	
60,000	.0658	.0018	
60,000	.0646	.0008	
60,000	.0649	.0006	

On gauged length M, across the top of oscillating slide, midway of slide.

1,000	0.	....	
10,000	.0032	....	
20,000	.0069	....	
30,000	.0107	....	
40,000	.0141	....	
50,000	.0180	....	
60,000	.0213	....	
50,000	.0201	....	
40,000	.0162	....	
80,000	.0078	....	
20,000	.0040	....	
10,000	.0007	−.0004	

On longitudinal gauged length O, from right cheek of oscillating slide, abreast trunnion, to fixed block on gun.

10,000	0.	....	
10,000	.0121	....	
20,000	.0309	....	
30,000	.0494	....	
40,000	.0657	....	
50,000	.0831	....	
60,000	.1007	....	
50,000	.1001	....	
40,000	.0990	....	
80,000	.0931	....	
20,000	.0658	....	
10,000	.0334	−.0010	
60,000	.1020	−.0011	

On gauged length P, from left cheek of oscillating slide, abreast trunnion, to fixed block on gun.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.		
10,000	.0187		
20,000	.0373		
30,000	.0545		
40,000	.0712		
50,000	.0879		
60,000	.1038		
50,000	.1038		
40,000	.1029		
30,000	.1002		
20,000	.0729		
10,000	.0409	0.	

Gun rotated 180°, and into position, bottom side up. On gauged point E, over front end of lug of oscillating slide.

1,000	0.		Movement takes place from the axis of the gun.
10,000	.0073		
20,000	.0134		
30,000	.0194		
40,000	.0250		
50,000	.0302		
60,000	.0353		
50,000	.0347		
40,000	.0338		
30,000	.0332		
20,000	.0257		
10,000	.0160	.0030	

On gauged point F, over rear end of lug of oscillating slide.

1,000	0.		Movement is toward axis of gun.
10,000	−.0012		
20,000	−.0027		
30,000	−.0047		
40,000	−.0062		
50,000	−.0075		
60,000	−.0090	.0	

On gauged point G, over front end of lug of sleeve.

1,000	0.		Movement is toward axis of gun.
10,000	.0012		
20,000	.0025		
30,000	.0043		
40,000	.0058		
50,000	.0072		
60,000	.0085	.0	

On gauged point H, over rear end of lug of sleeve.

1,000	0.		Movement is from axis of gun.
10,000	.0022		
20,000	.0038		
30,000	.0054		
40,000	.0067		
50,000	.0080		
60,000	.0096		
50,000	.0095		
40,000	.0094		
30,000	.0090		
20,000	.0068		
10,000	.0040	.0001	

On gauged point I, over rear end of cylinder.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.		Movement is from the gun.
10,000	.0069		
20,000	.0142		
30,000	.0211		
40,000	.0279		
50,000	.0344		
60,000	.0402		
50,000	.0397		
40,000	.0393		
30,000	.0367		
20,000	.0220		
10,000	.0087	−.0007	

On gauged point K, over rear end of piston rod.

1,000	0.		
10,000	.0068		
20,000	.0139		
30,000	.0207		
40,000	.0271		
50,000	.0339		
60,000	.0402	−.0013	

On gauged point J, over front end of piston rod.

1,000	0.		Movement from the gun.
10,000	.0002		
20,000	.0111		
30,000	.0290		
40,000	.0381		
50,000	.0470		
60,000	.0555		
50,000	.0540		
40,000	.0524		
30,000	.0502		
20,000	.0356		
10,000	.0191	.0008	
10,000	.0102		
20,000	.0201		
30,000	.0301		
40,000	.0382	.0007	

On gauged length A, from bottom of sleeve at rear end of lug to fixed block on gun.

1,000	0.		
10,000	.0055		
20,000	.0120		
30,000	.0185		
40,000	.0250		
50,000	.0315		
60,000	.0378		
50,000	.0380		
40,000	.0380		
30,000	.0375		
20,000	.0271		
10,000	.0150	.0012	

On gauged length C, from bottom of oscillating slide, front end of lug, to fixed block on gun.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	....	
10,000	.0041	....	
20.000	.0090	....	
30,000	.0138	....	
40,000	.0180	....	
50,000	.0225	....	
60,000	.0273	....	
50,000	.0274	....	
40,000	.0275	....	
30,000	.0276	....	
20,000	.0196	....	
10,000	.0108	.0015	

On gauged length D (difference of A and C), from bottom of sleeve, rear end of lug, to front end of lug of oscillating slide.

1,000	0.	....	Movement is one of approach of extremities of gauged length to each other.
10,000	−.0013	....	
20,000	−.0030	....	
30,000	−.0052	....	
40,000	−.0070	....	
50,000	−.0092	....	
60,000	−.0110	....	
60,000	−.0113	....	After 5 minutes.
60,000	−.0113	....	After 10 minutes.
50,000	−.0112	....	
50,000	−.0111	....	After 5 minutes.
40,000	−.0106	....	
40,000	−.0106	....	After 5 minutes.
30,000	−.0104	....	
30,000	−.0103	....	After 5 minutes.
25,000	−.0093	....	
25.000	−.0090	....	After 5 minutes.
25,000	−.0090	....	After 10 minutes.
22,000	−.0088	....	
22,000	−.0082	....	After 5 minutes.
20,000	−.0080	....	
20,000	−.0077	....	After 5 minutes.
18,000	−.0077	....	
18,000	−.0073	....	After 3 minutes.
15,000	−.0068	....	
12,000	−.0056	....	
10,000	−.0048	....	
8,000	−.0041	....	
6,000	−.0032	....	
4,000	−.0025	....	
2,000	−.0016	....	
1,000	....	−.0009	
1,000	....	−.0005	Set after resting 15 hours.

On gauged length B, over ends of piston rod.

1,000	0.	....	
10,000	.0026	....	
20,000	.0055	....	
30,000	.0083	....	
40,000	.0112	....	
50,000	.0143	....	
60,000	.0172	....	
50,000	.0171	....	
40,000	.0170	....	
30,000	.0161	....	
20,000	.0109	....	
10,000	.0055	.0008	
60,000	.0175	.0003	

No. 10282.

Observations for elongation of piston rod in special straining fixture.

Piston removed from the recoil cylinder and tested alone in special fixture.

On gauged length B, over ends of piston rod.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.		
5,000	.0016		
10,000	.0037		
15,000	.0058		
20,000	.0079		
25,000	.0099		
30,000	.0119		
35,000	.0140		
40,000	.0160		
42,800	.0172		
30,000	.0121		
20,000	.0080		
10,000	.0039		
1,000		.0001	
10,000	.0039		
20,000	.0080		
30,000	.0121		
35,000	.0140		
40,000	.0161		
42,800	.0172		
40,000	.0161		
35,000	.0141		
30,000	.0121		
20,000	.0080		
10,000	.0040	.0001	
30,000	.0121		
40,000	.0161		
45,000	.0183		
50,000	.0203		
55,000	.0224		
60,000	.0245		
1,000		.0001	
60,000	.0245		
1,000		.0001	

No. 10283.

Gun returned to testing machine for supplementary observations.

Gun in firing position, bottom side up. Counter recoil springs in the cylinder. Observations of resistance of moving gun into recoil position and return.

Resistance.	Travel of gun.	Remarks.
Pounds.	*Inches.*	
300	0.	Initial load.
2,180	.50	
2,400	1.00	
2,460	1.50	
2,620	2.00	
2,800	2.50	
3,060	3.00	
3,280	3.50	
3,470	4.00	
3,780	4.50	
4,200	4.86	
1,980	4.50	
1,820	4.00	
1,640	3.50	
1,420	3.00	
1,360	2.50	
1,100	2.00	
940	1.50	
630	1.00	
410	.50	
2,150	.50	
2,380	1.00	
2,510	1.50	
2,610	2.00	
2,840	2.50	
3,100	3.00	
3,340	3.50	
3,500	4.00	
3,780	4.50	
4,250	4.86	
2,010	4.50	
1,860	4.00	
1,710	3.50	
1,500	3.00	
1,340	2.50	
1,160	2.00	
920	1.50	
590	1.00	
340	.50	

Gun in firing position.

Gauge length from fixed block on gun to a point on the left trunnion.

Steel filling pieces in cylinder, counter recoil springs having been removed.

Applied loads.	Gauge reading.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.		Initial load.
10,000	.0265		
20,000	.0600		
30,000	.0877		
40,000	.1134		
50,000	.1332		
60,000	.1510		
50,000	.1485		
40,000	.1478		
30,000	.1421		
20,000	.1247		
10,000	.0898		
1,000		.0465	
			Micrometer reset to zero under initial load.
1,000	0.		
10,000	.0159		
20,000	.0382		
30,000	.0560		
40,000	.0728		
50,000	.0880		
60,000	.1041		
50,000	.1020		
40,000	.0994		
30,000	.0958		
20,000	.0809		
10,000	.0411		
1,000		.0002	
60,000	.1070		
1,000		.0005	
60,000	.1067		
1,000		.0007	
60,000	.1066		
1,000		.0007	

Gauged length from fixed block on gun to a point on the center of the right trunnion.

1,000	0.		
10,000	.0118		
20,000	.0305		
30,000	.0474		
40,000	.0631		
50,000	.0794		
60,000	.0939		
50,000	.0925		
40,000	.0902		
30,000	.0871		
20,000	.0757		
10,000	.0415		
1,000		.0012	
60,000	.0939		
1,000		.0006	

Gun in recoil position.

Gauged length from fixed block on gun to a point on the center of the right trunnion.

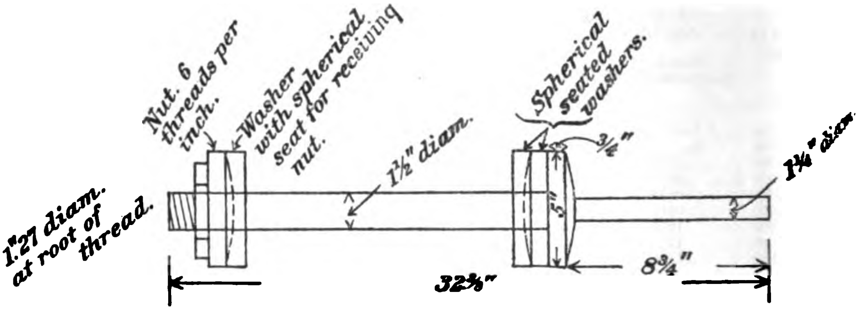
Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	....	Initial load.
10,000	.0193	....	
20,000	.0418	....	
30,000	.0613	....	
40,000	.0812	....	
50,000	.1012	....	
60,000	.1214	....	
50,000	.1180	....	
40,000	.1139	....	
30,000	.1055	....	
20,000	.0770	....	
10,000	.0429	....	
1,000	....	.0001	
60,000	.1233	....	
1,000	....	.0012	
60,000	.1238	....	
1,000	....	.0014	
60,000	.1245	....	
60,000	.1251	....	After 5 minutes.
60,000	.1254	....	After 10 minutes.
1,000	....	.0022	

Gauged length from fixed block on gun to point on the left trunnion.

1,000	0.	....	Initial load.
10,000	.0193	....	
20,000	.0409	....	
30,000	.0611	....	
40,000	.0811	....	
50,000	.1014	....	
60,000	.1215	....	
50,000	.1184	....	
40,000	.1141	....	
30,000	.1054	....	
20,000	.0755	....	
10,000	.0395	....	
1,000	....	.0004	
60,000	.1227	....	
60,000	.1226	....	After 5 minutes.
1,000	....	—.0010	

No. 10285.

FREE TEST OF PISTON ROD FOR 15-POUNDER GUN, FOR THE DRIGGS-SEABURY GUN AND AMMUNITION COMPANY, DERBY, CONN.


Nut. 6 threads per inch.
Washer with spherical seat for receiving nut.
1½" diam.
Spherical seated washers.
¾"
5"
1¼" diam.
1.27 diam. at root of thread.
32⅝"
8¾"

Measurements taken by means of a caliper over ends of rod.

Loads of tension applied to the rod between the head and spherical seated nut. Washers with spherical seats used to secure axial direction of line of pull.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0014	....	
10,000	.0035	....	
20,000	.0075	....	
30,000	.0117	....	
40,000	.0159	....	
50,000	.0198	....	
60,000	.0238	—.0002	
70,000	.0283	....	
80,000	.0324	....	
90,000	.0366	....	
100,000	.0410	—.0002	
110,000	.0451	....	
120,000	.0497	....	
131,966	.0549	—.0002	

Test discontinued.

The apparent minus set of ".0002 was attributed to a change in the temperature of the caliper arm employed during the progress of the test.

No. 10286.

DRIGGS-SEABURY 15-POUNDER GUN NO. 12, WITH STEEL OSCILLATING SLIDE IN LIEU OF THE BRONZE SLIDE.

Gun in firing position, bottom side up.

Measurements on gauged length A, bottom of sleeve, rear end of lug to fixed block on gun.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	.0040	....	
20,000	.0104	....	
30,000	.0164	....	
40,000	.0227	....	
50,000	.0282	....	
60,000	.0340	....	
50,000	.0340	....	
40,000	.0340	....	
30,000	.0337	....	
20,000	.0261	....	
10,000	.0133	....	
1,000	....	0.	

Measurements on gauged length C, from bottom of oscillating slide, front end of lug to fixed block on gun.

1,000	0.	0.	Initial load.
10,000	.0030	....	
20,000	.0098	....	
30,000	.0165	....	
40,000	.0225	....	
50,000	.0282	....	
60,000	.0342	....	
50,000	.0342	....	
40,000	.0342	....	
30,000	.0342	....	
20,000	.0265	....	
10,000	.0141	....	
1,000	....	.0017	
60,000	.0356	....	
1,000	....	.0017	

On gauged length B, over end of piston rod.

1,000	0.	0.	Initial load.
10,000	.0031	....	
20,000	.0061	....	
30,000	.0092	....	
40,000	.0124	....	
50,000	.0155	....	
60,000	.0185	....	
50,000	.0185	....	
40,000	.0183	....	
30,000	.0177	....	
20,000	.0116	....	
10,000	.0059	....	
1,000	....	.0006	

Gun rotated 180° and brought right side up. Measurements on gauged length L, across top of oscillating slide at rear end.

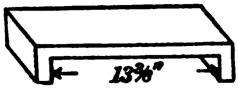
Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	.0182	....	
20,000	.0324	....	
30,000	.0425	....	
40,000	.0496	....	
50,000	.0552	....	
60,000	.0608	....	
50,000	.0584	....	
40,000	.0524	....	
30,000	.0428	....	
20,000	.0305	....	
10,000	.0199	....	
1,000	....	0.	

Measurements on gauged length M.

1,000	0.	0.	Initial load.
10,000	.0082	....	
20,000	.0144	....	
30,000	.0184	....	
40,000	.0222	....	
50,000	.0253	....	
60,000	.0284	....	
50,000	.0272	....	
40,000	.0251	....	
30,000	.0173	....	
20,000	.0115	....	
10,000	.0062	....	
1,000	....	.0005	

Measurements on gauged length N.

1,000	0.	0.	Initial load.
10,000	−.0020	....	Movement inward toward the gun.
20,000	−.0065	....	
30,000	−.0103	....	
40,000	−.0127	....	
50,000	−.0151	....	
60,000	−.0172	....	
50,000	−.0175	....	
40,000	−.0168	....	
30,000	−.0144	....	
20,000	−.0113	....	
10,000	−.0072	....	
1,000	....	−.0004	

Iron dog  4½" x 1" fitted across the cheeks of the steel oscillating slide at the rear end, in order to restrict the outward movement of the slide at this place.

Measurements on gauged length N.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	−.0017		Movement inward toward the gun.
20,000	−.0041		
30,000	−.0094		
40,000	−.0118		
50,000	−.0139		
60,000	−.0159		
50,000	−.0167		
40,000	−.0158		
30,000	−.0135		
20,000	−.0110		
10,000	−.0076		
1,000		−.0015	

Measurements on gauged length M.

1,000	0.	0.	Initial load.
10,000	.0030		
20,000	.0038		
30,000	.0058		
40,000	.0070		
50,000	.0089		
60,000	.0109		
50,000	.0092		
40,000	.0066		
30,000	.0020		
20,000	.0002		
10,000	−.0005		
1,000		−.0002	

Gauged length L inaccessible on account of the presence of the iron dog.

Gun rotated 180° and brought bottom side up. Iron dog still in place.

Measurements on gauged length B, over ends of piston rod.

1,000	0.	0.	Initial load.
10,000	.0031		
20,000	.0066		
30,000	.0099		
40,000	.0130		
50,000	.0163		
60,000	.0192		
50,000	.0192		
40,000	.0189		
30,000	.0163		
20,000	.0106		
10,000	.0051		
1,000		.0003	

Screw jacks under rear end of slide.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	....	.0005	
60,000	.0205	....	
60,000	.0207	....	Slide and eye-bar fixtures jarred with hammer.
1,000	....	.0007	

Iron dog removed.
Slide lubricated with Albany grease and graphite.

1,000	....	.0008	
60,000	.0212	....	
1,000	....	.0008	
60,000	.0213	....	
1,000	....	.0008	

Iron dog returned to place.

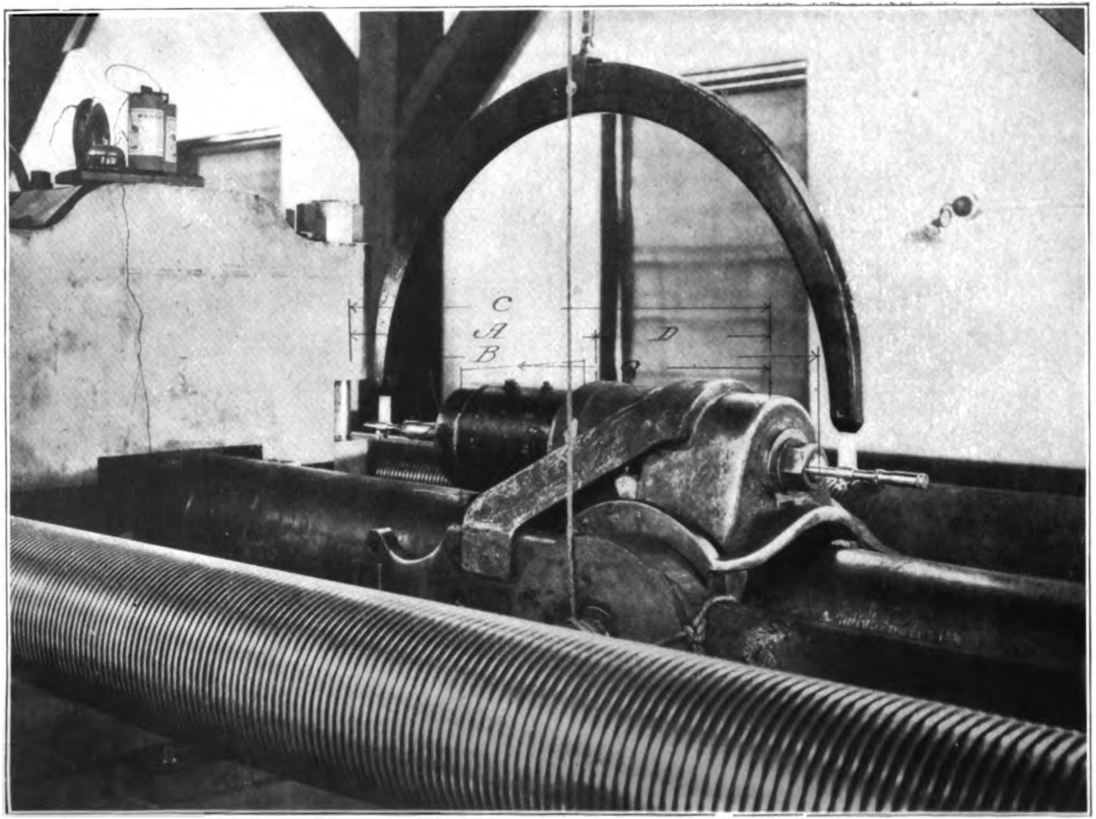
1,000	....	.0008	
60,000	.0215	....	
1,000	....	.0008	
60,000	.0215	....	
60,000	.0217	....	Lug on slide jarred with hammer.
1,000	....	.0008	
60,000	–.0031	....	Lug on slide jarred continuously while load was advanced.
1,000	....	–.0244	Micrometer evidently disturbed in its position.

Suspension sling of crane lowered and screw jacks put under trunnions and a part of the weight of the gun carried by the jacks.

1,000	....	–.0246	
60,000	–.0036	....	
60,000	–.0038	....	Muzzle of gun raised by a screw jack. Jacks removed from under trunnions.

Jack removed and part of weight of gun carried by suspension sling of crane.
Recoil cylinder opened and packing removed.
Again assembled and test resumed.

1,000	....	–.0248	
60,000	-.0045	....	



TEST OF RECOIL MECHANISM OF DRIGGS-SEABURY 15-POUNDER GUN NO. 12.

Photograph No. 1, showing [illegible]

Simultaneous readings taken are gauged lengths A^1 and B. Gauged length A^1 established from fixed block near rear end of recoil cylinder to rear end of lug of sleeve.

Applied loads.	Gauge readings.		Remarks.
	On A^1.	On B.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Micrometers reset at zero.
10,000	.0061	.0031	
20,000	.0141	.0066	
40,000	.0288	.0138	
60,000	.0420	.0205	
70,000	.0701	.0232	
1,000	.0228	0.	
72,000	.0879	.0241	
1,000	.0388	0.	

RECOIL MECHANISM OF DRIGGS-SEABURY FIFTEEN-POUNDER GUN, No. 12.

SUPPLEMENTARY TEST WITH REENFORCED CAST-STEEL SLEEVE AND REENFORCED BRONZE OSCILLATING SLIDE.

The sleeve was reenforced by additional metal, gusset shaped, at the root of the lug. The oscillating slide had a ribbed steel cap across the top and a steel lug brace on the bottom side.

Gauged lengths designated by the letters before used in the tests with this gun refer to the same places on the gun. The new gauged length Q was established to show the movement of the slide within itself, and was defined at one extremity on the front end of the lug, and at the other end on a strap which was bolted to the sides of the slide at the rear end.

The tests were made in the order in which the details are reported. Following the methods of previous tests, loads were applied in successive increments up to 60,000 pounds tension, and then observing the resilience as the loads were successively reduced.

In the present tests, observations on gauged length A showed an extension of ".0090, against ".0340 in the earlier test, indicating apparently a greater degree of rigidity in the reenforced steel sleeve over the ordinary bronze sleeve.

On gauged length C a greater movement was observed than in the previous test, a part of which excess was attributed to the greater strains developed in the piston rod and the remainder to the slide itself. The net movement of the piston rod, gauged length B, was found to be ".0210 to ".0211, against ".0179 of the previous test. Special treatment in the earlier test had been the means of obtaining a higher extension. This comparison, however, refers to the ordinary state of the mechanism.

In recoil position, during the present test, the total extension of the piston was ".0197 to ".0201.

On a gauged length from corner to corner of the rear lower end of the slide, a movement of ".123 and ".115 was found when the gun was in firing and recoil positions, respectively. This movement took place in an outward direction.

After tests in the firing and then in the recoil position of the gun, the gun was returned to firing position and simultaneous readings taken on gauged lengths A and B. Loads were increased until the extension of the piston rod indicated that 60,000 pounds tension had reached that part, which occurred when a load of about 69,000 pounds was on the mechanism. Loads were increased to 72,000 pounds tension, the maximum stress of the preceding test.

No. 10305.

Gun in firing position, bottom side up.

On gauged length A, bottom of sleeve, rear end of lug, to fixed block on gun.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	.0010	....	
20,000	.0027	....	
30,000	.0040	....	
40,000	.0059	....	
50,000	.0074	....	
60,000	.0090	....	
50,000	.0090	....	
40,000	.0089	....	
30,000	.0066	....	
20,000	.0044	....	
10,000	.0024	....	
1,000	....	.0001+	
60,000	.0090	....	
1,000	....	.0002	
1,000	....	0.	After one-half hour rest.
60,000	.0090	....	
1,000	....	.0001	

On gauged length C, from bottom of oscillating slide, front end of lug, to fixed block on gun.

1,000	0.	0.	Initial load.
10,000	.0055	....	
20,000	.0110	....	
30,000	.0162	....	
40,000	.0212	....	
50,000	.0257	....	
60,000	.0304	....	
50,000	.0304	....	
40,000	.0300	....	
30,000	.0215	....	
20,000	.0147	....	
10,000	.0078	....	
1,000	....	.0008	
60,000	.0307	....	
1,000	....	.0008−	
60,000	.0313	....	
1,000	....	.0009	

On gauged length B, over ends of piston rod.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	.0032	....	
20,000	.0066	....	
30,000	.0101	....	
40,000	.0136	....	
50,000	.0169	....	
60,000	.0204	....	
50,000	.0202	....	
40,000	.0197	....	
30,000	.0135	....	
20,000	.0066	....	
10,000	.0036	....	
1,000	....	−.0006	
60,000	.0204	....	
1,000	....	−.0006	
10,000	.0025	....	
20,000	.0063	....	
30,000	.0095	....	
40,000	.0132	....	
50,000	.0167	....	
60,000	.0202	....	
50,000	.0199	....	
40,000	.0185	....	
30,000	.0127	....	
20,000	.0078	....	
10,000	.0033	....	
1,000	....	−.0009	

On a gauged length across rear, lower (when gun is in natural position) corners of the oscillating slide.

1,000	0.	0.	Initial load
10,000	.021	....	
20,000	.045	....	
30,000	.067	....	
40,000	.087	....	
50,000	.106	....	
60,000	.123	....	
50,000	.122	....	
40,000	.120	....	
30,000	.108	....	
20,000	.071	....	
10,000	.035	....	
1,000	.0	....	

On gauged length Q, from bottom of oscillating slide, front end of lug, to strap fixed to rear end of slide, and encircling the recoil cylinder, showing movement of the slide within itself.

1,000	0.	0.	Initial load. Movement on overturning one, toward the rear.
10,000	−.0045	....	
20,000	−.0091	....	
30,000	−.0129	....	
40,000	−.0162	....	
50,000	−.0198	....	
60,000	−.0219	....	
50,000	−.0217	....	
40,000	−.0200	....	
30,000	−.0152	....	
20,000	−.0105	....	
10,000	−.0046	....	
1,000	....	+.0003	
60,000	−.0216	....	
1,000	....	+.0007	
60,000	−.0217	....	
1,000	....	+.0005	

Gun in position at half recoil.

One 2½″ special filling piece in the cylinder. Measurements taken on gauged length Q.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	−.0043	....	
20,000	−.0095	....	
30,000	−.0140	....	
40,000	−.0176	....	
50,000	−.0211	....	
60,000	−.0240	....	
50,000	−.0237	....	
40,000	−.0227	....	
30,000	−.0192	....	
20,000	−.0131	....	
10,000	−.0078	....	
1,000	....	−.0015	
60,000	−.0246	....	
1,000	....	−.0024	
60,000	−.0258	....	
1,000	....	−.0031	
60,000	−.0271	....	
1,000	....	−.0040	

Gun in recoil position.

On gauged length across rear, lower (when gun is in natural position) corners of the oscillating side.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	.016	....	
20,000	.037	....	
30,000	.057	....	
40,000	.077	....	
50,000	.096	....	
60,000	.115	....	
50,000	.115	....	
40,000	.114+	....	
30,000	.114	....	
20,000	.087	....	
10,000	.043	....	
1,000	....	0.	

On gauged length B, over ends of piston rod.

1,000	0.	0.	Initial load.
10,000	.0027	....	
20,000	.0060	....	
30,000	.0095	....	
40,000	.0127	....	
50,000	.0162	....	
60,000	.0195	....	
50,000	.0194	....	
40,000	.0188	....	
30,000	.0134	....	
20,000	.0084	....	
10,000	.0037	....	
1,000	....	−.0002	
60,000	.0199	....	
1,000	....	−.0002	
60,000	.0199	....	
1,000	....	−.0002	

On gauged length C, from bottom of oscillating slide, front end of lug, to fixed block on gun.

Applied loads.	Gauge readings.		Remarks.
	Direct movement.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	.0046		
20,000	.0095		
30,000	.0141		
40,000	.0191		
50,000	.0236		
60,000	.0279		
50,000	.0281		
40,000	.0252		
30,000	.0184		
20,000	.0117		
10,000	.0063		
1,000		−.0002	
60,000	.0282		
50,000	.0282		
1,000		0.	

On gauged length A, bottom of sleeve, rear end of lug, to fixed block on the gun.

1,000	0.	0.	
10,000	.0013		
20,000	.0027		
30,000	.0043		
40,000	.0060		
50,000	.0078		
60,000	.0097		
50,000	.0095		
40,000	.0086		
30,000	.0064		
20,000	.0039		
10,000	.0019		
1,000		0.	

On gauged length Q, from bottom of oscillating slide, front end of lug, to strap fixed to rear end of slide, showing movement of the slide within itself.

1,000	0.	0.	Initial load.
10,000	−.0044		
20,000	−.0093		
30,000	−.0139		
40,000	−.0179		
50,000	−.0216		
60,000	−.0254		
50,000	−.0256		
40,000	−.0248		
30,000	−.0201		
20,000	−.0141		
10,000	−.0071		
1,000		+.0005	
60,000	−.0256		
1,000		+.0012	
60,000	−.0255		
1,000		+.0016	
1,000		+.0017	After 10 minutes' rest.
60,000	−.0253		
1,000		+.0019	
60,000	−.0252		
1,000		+.0017	

Gun in firing position.

Simultaneous readings taken on gauged lengths A^1 and B.

Gauged length A^1 established from fixed block on the gun near rear end of recoil cylinder to rear end of lug sleeve.

Applied loads.	Gauge readings.		Remarks.
	On A^1.	On B.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
10,000	.0015	.0031	
20,000	.0026	.0065	
30,000	.0041	.0102	
40,000	.0056	.0140	
50,000	.0072	.0176	
60,000	.0089	.0207	
65,000	.0095	.0227	
68,000	.0100	.0238	
69,000	.0101	.0241	
1,000	0.	0.	
72,000	.0110	.0257	
1,000	.0003	.0002	
72,000	.0114	.0261	
1,000	.0002	.0003	
72,000	.0114	.0261	
1,000	.0002	.0003	

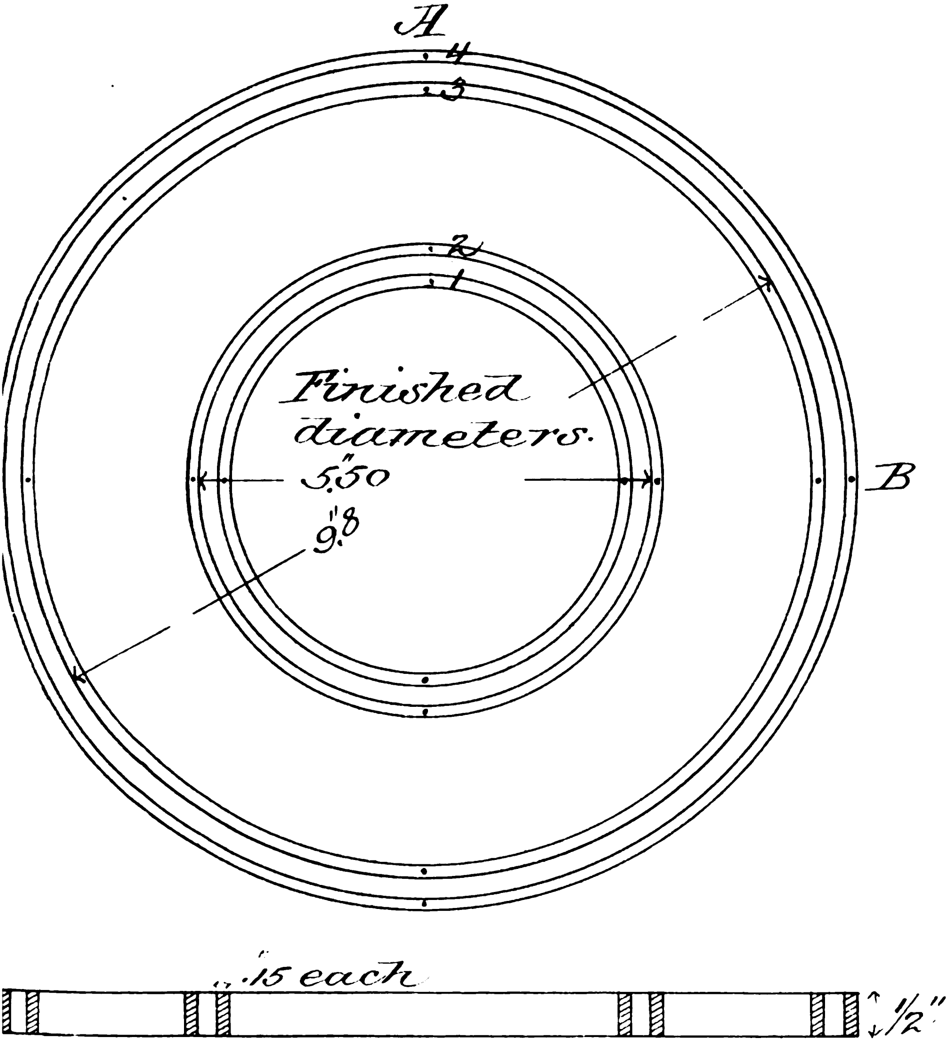
On gauged length C, from bottom of oscillating slide, front end of lug, to fixed block on gun.

1,000	0.	0.	Initial load.
10,000	.0057	....	
20,000	.0108	....	
30,000	.0157	....	
40,000	.0207	....	
50,000	.0251	....	
60,000	.0302	....	
70,000	.0349	....	
72,000	.0354	....	
70,000	.0354	....	
60,000	.0354+	....	
50,000	.0353	....	
40,000	.0272	....	
30,000	.0201	....	
20,000	.0135	....	
10,000	.0072	....	
1,000	....	.0001	

INTERNAL STRAINS IN GUN FORGINGS.

SLICES FROM THE TUBES OF 5-INCH R. F. GUNS.

5-inch R. F. Gun Tubes.
Breech Slices.



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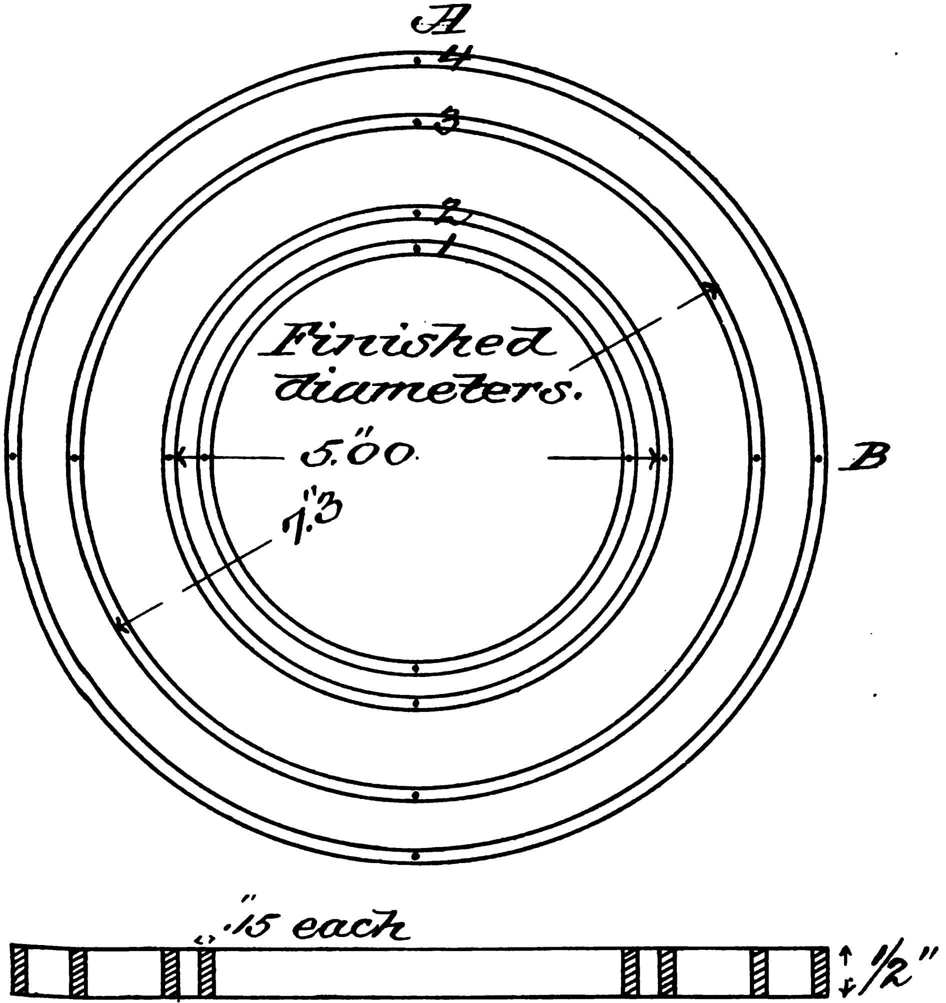
5-inch R. F. Gun Tubes. Muzzle Slices.



THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

INTERNAL STRAINS IN GUN FORGINGS.

Internal strains were introduced by heating the forgings and cooling the same rapidly by quenching from the bore.

These determinations were made upon the metal from the tubes of 5-inch R. F. guns.

The initial temperature of the tubes at the time of quenching was generally between 850° and 900° F., with a rate of flow for the water of about 100 gallons per minute. Where more than one set of determinations appear for the same tube it indicates that the metal had been re-treated or annealed between operations.

The numbers of the several tubes, with the compression stresses corresponding to the strains found in the rings next the bore of the forgings, are shown in the following table:

No. of tube.	Compressive stress next the bore per square inch.		Remarks.
	Breech end.	Muzzle end.	
	Pounds.	*Pounds.*	
11249 B_2	44,300	49,000	Discard, ⅛".
11272 B_3		27,800	Muzzle crop end after second annealing at 360° F.
11272 B_3 BM	85,500		
11272 B_3 BM—A	29,700		Annealed at 450° F.
11272 B_3 BO—A	25,200		Annealed at 600° F.
11363 B_1	35,900	18,800	Discard, ⅛".
11363 B_1	43,500	36,700	
11363 B_2	40,500	42,400	Discard, ⅛".
11363 B_3	36,200		Discard, ⅜".
11363 B_3	35,900	87,500	
11467 B_1	40,200	39,900	Discard, ⅛".
11775 B_2	33,000	35,300	Discard, ⅛".
11775 B_2	26,000 22,800	42,600 44,500	
11775 B_4 MM		27,000	
11775 B_4 MO		24,900	
11775 B_4 MI		25,600	
11784 B_1	47,600	38,600	
11784 B_1	16,800	34,100	Breech end after annealing 7 feet at 665° F.
11784 B_1	15,900	14,900	
11784 B_1	40,100	23,000	
11784 B_1	19,400		Breech end after annealing 7 feet at 650° F.
11784 B_3 BM	30,300		
11784 B_3 BO—A	24,000		Annealed at 600° F.
11784 B_3 BM—A	17,200		Annealed at 750° F.
11791 B_1	23,300	25,600	Discard, ⅛".
11791 B_1	31,700	28,100	
11791 B_1	22,700	26,000	After annealing at 650° F.
11791 B_2	43,800	42,400	
11794 B_5	31,200	32,500	Discard, ⅛".
11794 B_5	47,000	42,100	
11794 B_5	25,700		Breech end after annealing 7 feet at 665° F.
11837 B_2	55,500	17,400	
11837 B_3	36,100	45,000	
12485 B_7 BI	29,300		
12485 B_7 BM	25,800		
12485 B- BI—A	20,200		Annealed at 750° F.
12485 B_7 BM—A	26,300		Annealed at 600° F.
12485 B_7 BO—A	23,300		Annealed at 450° F.
20691 B_3	34,100	43,200	
20691 B_3	45,000	15,400	

TUBE 11249 B_2.

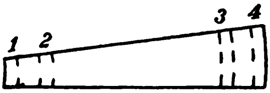
BREECH SLICE.

(⅜″ discard.)

State of internal strains and stresses at different phases of the slice.

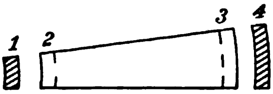
SLICE INTACT.

Interior diameter of slice, 4″.74; exterior diameter of slice, 10″.36.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.90915		.00725		44,300
2	5.6495		.00375		19,900
3	9.6404	.00535		16,600	
4	10.2066		.00035		1,000

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.9164				
2	5.6478		.00545		28,900
3	9.63925	.0042		13,100	
4 detached	10.20695				

RINGS ALL DETACHED.

2 detached	5.65325				
3 detached	9.63505				

Breech Slice.

Interior diameter, 4″.74; exterior diameter, 10″.36.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9093	4.9090	4.90915
2	5.6481	5.6509	5.6495
3	9.6443	9.6365	9.6404
4	10.2112	10.2020	10.2066

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9154	4.9174	4.9164
2	5.6467	5.6489	5.6478
3	9.6433	9.6352	9.63925
4 detached	10.2135	10.2004	10.20695

RINGS ALL DETACHED.

2 detached	5.6515	5.6550	5.65325
3 detached	9.6376	9.6325	9.63505

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0061	+.0084	+.00725
2 in slice	−.0014	−.0020	−.0017
3 in slice	−.0010	−.0013	−.00115
4 detached	+.0023	−.0016	+.00035

SECOND TO THIRD PHASE.

2 detached	+.0048	+.0061	+.00545
3 detached	−.0057	−.0027	−.0042

FIRST TO THIRD PHASE.

2 detached	+.0034	+.0041	+.00375
3 detached	−.0067	−.0040	−.00535

TUBE 11249 B_2.

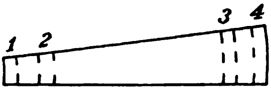
MUZZLE SLICE.

($\frac{3}{8}$" discard.)

State of internal strains and stresses at different phases of the slice.

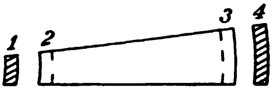
SLICE INTACT.

Interior diameter of slice, 4".20; exterior diameter of slice, 8".52



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3451	....	.0071	....	49,000
2	5.1473	....	.0024	....	14,000
3	7.14445	.0045	....	18,900	....
4	8.36205	.0025	....	9,000	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5".00; exterior diameter of slice, 7".31



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3522	....	....	....	....
2	5.1460	....	.0037	....	21,600
3	7.1437	.00375	....	15,700	....
4 detached	8.35955	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.1497	....	....	....	....
3 detached	7.13995	....	....	....	....

Muzzle Slice.

Interior diameter, 4″.20; exterior diameter, 8″.52.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3450	4.3452	4.3451
2	5.1479	5.1467	5.1473
3	7.1545	7.1344	7.14445
4	8.3604	8.3637	8.36205

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3511	4.3533	4.3522
2	5.1470	5.1450	5.1460
3	7.1541	7.1333	7.1437
4 detached	8.3514	8.3677	8.35955

RINGS ALL DETACHED.

2 detached	5.1504	5.1490	5.1497
3 detached	7.1509	7.1290	7.13995

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0061	+.0081	+.0071
2 in slice	−.0009	−.0017	−.0013
3 in slice	−.0004	−.0011	−.00075
4 detached	−.0090	+.0040	−.0025

SECOND TO THIRD PHASE.

2 detached	+.0034	+.0040	+.0037
3 detached	−.0032	−.0043	−.00375

FIRST TO THIRD PHASE.

2 detached	+.0025	+.0023	+.0024
3 detached	−.0036	−.0054	−.0045

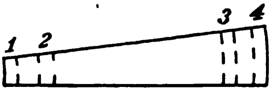
TUBE 11272 B_3.

MUZZLE SLICE.

Muzzle crop end after second annealing at 360° F.
State of internal strains and stresses at different phases of the slice.

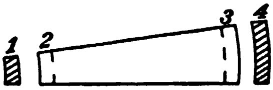
SLICE INTACT.

Interior diameter of slice, 4″.27; exterior diameter of slice, 8″.92.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.4186		.0041		27,800
2	5.1469		.00225		13,100
3	7.1359	.0028		11,800	
4	8.7701		.0026		8,900

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.4227				
2	5.1464		.00275		16,000
3	7.13555	.00245		10,300	
4 detached	8.7727				

RINGS ALL DETACHED.

2 detached	5.14915				
3 detached	7.1331				

MUZZLE SLICE.

Interior diameter, 4″.27; exterior diameter, 8″.92.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.4146	4.4226	4.4186
2	5.1476	5.1462	5.1469
3	7.1357	7.1361	7.1359
4	8.7661	8.7741	8.7701

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.4185	4.4269	4.4227
2	5.1473	5.1455	5.1464
3	7.1356	7.1355	7.13555
4 detached	8.7595	8.7859	8.7727

RINGS ALL DETACHED.

2 detached	5.1496	5.1487	5.14915
3 detached	7.1329	7.1333	7.1331

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0039	+.0043	+.0041
2 in slice	−.0003	−.0007	−.0005
3 in slice	−.0001	−.0006	−.00035
4 detached	−.0066	+.0118	+.0026

SECOND TO THIRD PHASE.

2 detached	+.0023	+.0032	+.00275
3 detached	−.0027	−.0022	−.00245

FIRST TO THIRD PHASE.

2 detached	+.0020	+.0025	+.00225
3 detached	−.0028	−.0028	−.0028

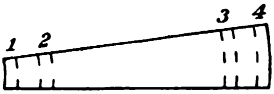
TUBE 11272 B_3 BM.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

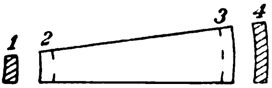
SLICE INTACT

Interior diameter of slice, 4″.76; exterior diameter of slice, 10″.42.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.86155		.00575		35,500
2	5.6598		.0036		19,100
3	9.64915	.0053		16,500	
4	10.2741	.0014		4,100	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8673				
2	5.6584		.0050		26,500
3	9.64845	.0046		14,300	
4 detached	10.2730				

RINGS ALL DETACHED.

2 detached	5.6634				
3 detached	9.64385				

BREECH SLICE.

Interior diameter, 4″.76; exterior diameter, 10″.42.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8623	4.8608	4.86155
2	5.6583	5.6613	5.6598
3	9.6536	9.6447	9.64915
4	10.2731	10.2757	10.2744

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8674	4.8672	4.8673
2	5.6570	5.6598	5.6584
3	9.6530	9.6439	9.64845
4 detached	10.2543	10.2917	10.2730
RINGS ALL DETACHED.			
2 detached	5.6621	5.6647	5.6634
3 detached	9.6481	9.6396	9.64385

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0051	+.0064	+.00575
2 in slice	-.0013	-.0015	-.0014
3 in slice	.0006	.0008	.0007
4 detached	.0188	+.0160	.0014
SECOND TO THIRD PHASE.			
2 detached	+.0051	+.0049	+.0050
3 detached	.0049	.0043	.0046
FIRST TO THIRD PHASE.			
2 detached	+.0038	+.0034	+.0036
3 detached	.0055	.0051	.0053

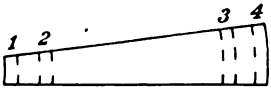
TUBE 11272 B_3 BM--A.

BREECH SLICE.

Annealed at 450° F.
State of internal strains and stresses at different phases of the slice.

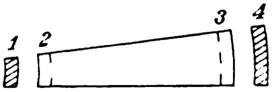
SLICE INTACT.

Interior diameter of slice, 4″.72; exterior diameter of slice, 10″.42.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.85005		.0048		29,700
2	5.6501		.00325		17,500
3	9.6492	.0051		16,800	
4	10.27315	.0007		2,000	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.85485				
2	5.6491		.00425		22,600
3	9.6486	.0048		14,900	
4 detached	10.27245				

RINGS ALL DETACHED.

2 detached	5.65335				
3 detached	9.6438				

BREECH SLICE.

Interior diameter, 4″.72; exterior diameter, 10″.42.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8501	4.8500	4.85005
2	5.6520	5.6482	5.6501
3	9.6483	9.6501	9.6492
4	10.2784	10.2679	10.27315

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8547	4.8550	4.85485
2	5.6508	5.6474	5.6491
3	9.6476	9.6496	9.6486
4 detached	10.2847	10.2602	10.27245
RINGS ALL DETACHED.			
2 detached	5.6549	5.6518	5.65335
3 detached	9.6464	9.6412	9.6438

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0046	+.0050	+.0048
2	−.0012	−.0008	−.0010
3	−.0007	−.0005	−.0006
4 detached	+.0063	−.0077	−.0007
RINGS ALL DETACHED.			
2 detached	+.0041	+.0044	+.00425
3 detached	.0012	.0084	.0048
FIRST TO THIRD PHASE.			
2 detached	+.0029	+.0036	+.00325
3 detached	.0019	.0089	.0054

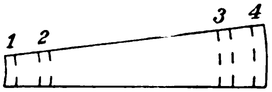
TUBE 11272 B_3 BO—A.

BREECH SLICE.

Annealed at 600° F.
State of internal strains and stresses at different phases of the slice.

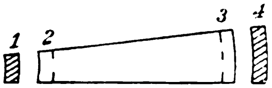
SLICE INTACT.

Interior diameter of slice, 4″.73; exterior diameter of slice, 10″.43.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.87835		.0041		25,200
2	5.6503		.0032		17,000
3	9.6487	.00265		8,200	
4	10.2792		.00095		2,800

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.88215				
2	5.61915		.00405		21,500
3	9.6482	.00215		6,700	
4 detached	10.28015				

RINGS ALL DETACHED.

2 detached	5.6535				
3 detached	9.64605				

BREECH SLICE.

Interior diameter, 4″.73; exterior diameter, 10″.43.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8780	4.8787	4.87835
2	5.6474	5.6532	5.6503
3	9.6484	9.6490	9.6487
4	10.2776	10.2808	10.2792

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8829	4.8820	4.88245
2	5.6462	5.6527	5.64945
3	9.6476	9.6488	9.6482
4 detached	10.2862	10.2741	10.28015
RINGS ALL DETACHED.			
2 detached	5.6504	5.6566	5.6535
3 detached	9.6458	9.6463	9.64605

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0049	+.0033	+.0041
2 in slice	−.0012	−.0005	−.00085
3 in slice	−.0008	−.0002	−.0005
4 detached	+.0086	−.0067	+.00095
SECOND TO THIRD PHASE.			
2 detached	+.0042	+.0039	+.00405
3 detached	−.0018	−.0025	−.00215
FIRST TO THIRD PHASE.			
2 detached	+.0030	.0034	+.0032
3 detached	.0026	.0027	−.00265

TUBE 11363 B$_1$.

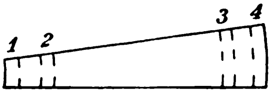
BREECH SLICE.

(2″ discard.)

State of internal strains and stresses at different phases of the slice.

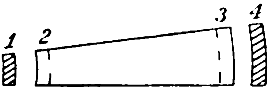
SLICE INTACT.

Interior diameter of slice, 4″.73; exterior diameter of slice, 10″.47.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.89305	…………	.00585	…………	35,900
2	5.65465	…………	.00235	…………	12,500
3	9.64695	.00135	…………	13,500	…………
4	10.32205	.0024	…………	7,000	…………

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8989	…………	…………	…………	…………
2	5.65375	…………	.00325	…………	17,200
3	9.6465	.0039	…………	12,100	…………
4 detached	10.31965	…………	…………	…………	…………

RINGS ALL DETACHED.

2 detached	5.6570	…………	…………	…………	…………
3 detached	9.6426	…………	…………	…………	…………

BREECH SLICE.

Interior diameter, 4″.73; exterior diameter, 10″.47.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8914	4.8947	4.89305
2	5.6505	5.6588	5.65465
3	9.6407	9.6532	9.64695
4	10.3135	10.3306	10.32205

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8979	4.8999	4.8989
2	5.6494	5.6581	5.65375
3	9.6401	9.6529	9.6465
4 detached	10.3153	1o.3240	10.31965
RINGS ALL DETACHED.			
2 detached	5.6525	5.6615	5.6570
3 detached	9.6382	9.6470	9.6426

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0065	+.0052	+.00585
2 in slice	.0011	−.0007	−.0009
3 in slice	−.0006	.0003	−.00045
4 detached	+.0018	−.0066	−.0024
SECOND TO THIRD PHASE.			
2 detached	−.0031	+.0034	+.00325
3 detached	−.0019	−.0059	−.0039
FIRST TO THIRD PHASE.			
2 detached	+.0020	.0027	+.00235
3 detached	.0025	.0062	−.00435

TUBE 11363 B_1.

MUZZLE SLICE.

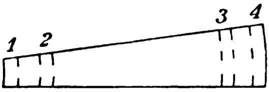
(⅝″ discard.)

Bore eccentric. Ring 4, minimum thickness, 0″.15; maximum thickness, 0″.30.

State of internal strains and stresses at different phases of the slice.

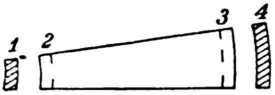
SLICE INTACT.

Interior diameter of slice, 4″.16; exterior diameter of slice, 8″.61.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3112	....	.0027	....	18,800
2	5.1588	....	.00105	....	6,100
3	7.13725	.00195	....	8,100	....
4	8.2667	.0021	....	7,600	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3139	....	....	....	....
2	5.1587	....	.00115	....	6,700
3	7.13745	.00215	....	9,000	....
4 detached	8.2646	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.15985	....	....	....	....
3 detached	7.1375	....	....	....	....

MUZZLE SLICE.

Interior diameter, 4″.16; exterior diameter, 8″.61.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3083	4.3141	4.3112
2	5.1575	5.1601	5.1588
3	7.1377	7.1368	7.13725
4	8.2646	8.2688	8.2667

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3107	4.3171	4.3139
2	5.1572	5.1602	5.1587
3	7.1377	7.1372	7.13745
4 detached	8.2578	8.2714	8.2646
RINGS ALL DETACHED.			
2 detached	5.1595	5.1602	5.15985
3 detached	7.1359	7.1347	7.1353

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0024	+.0030	+.0027
2 in slice	.0008	+.0001	.0001
3 in slice	.0000	+.0004	+.0002
4 detached	−.0068	+.0026	−.0021
SECOND TO THIRD PHASE.			
2 detached	+.0023	+.0000	+.00115
3 detached	.0018	.0025	.00215
FIRST TO THIRD PHASE.			
2 detached	+.0020	+.0001	+.00105
3 detached	.0018	.0021	.00195

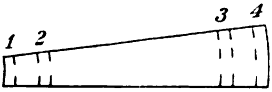
TUBE 11363 B_1.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

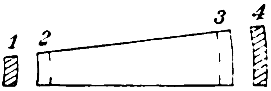
SLICE INTACT.

Interior diameter of slice, 4″.72; exterior diameter of slice, 10″.44.



Rings	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.8605	....	.00705	....	43,500
2	5.6455	....	.0038	....	20,200
3	9.6457	.0049	....	15,200	....
4	10.30785	.0056	....	16,300	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.86755	....	....	....	....
2	5.64125	....	.00505	....	26,800
3	9.6448	.0040	....	12,400	....
4 detached	10.30225	....	....	....	....

RINGS ALL DETACHED

2 detached	5.6493	....	....	....	....
3 detached	9.6468	....	....	....	....

BREECH SLICE.

Interior diameter, 4″.72; exterior diameter, 10″.44.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8570	4.8640	4.8605
2	5.6424	5.6486	5.6455
3	9.6462	9.6452	9.6457
4	10.2971	10.3186	10.30785

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8635	4.8716	4.86755
2	5.6413	5.6472	5.64425
3	9.6453	9.6443	9.6448
4 detached	10.2816	10.3229	10.30225

RINGS ALL DETACHED.

2 detached	5.6462	5.6524	5.6493
3 detached	9.6401	9.6415	9.6408

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0065	+.0076	+.00705
2 in slice	.0011	.0014	.00125
3 in slice	−.0009	.0009	.0009
4 detached	−.0155	−.0043	−.0056

SECOND TO THIRD PHASE.

2 detached	+.0049	+.0052	+.00505
3 detached	−.0052	−.0028	−.0040

FIRST TO THIRD PHASE.

2 detached	+.0038	+.0038	+.0038
3 detached	−.0061	−.0037	−.0049

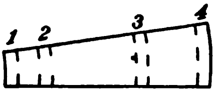
TUBE 11363 B_1.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

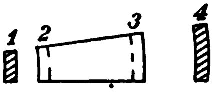
SLICE INTACT.

Interior diameter of slice, 4″.18; exterior diameter of slice, 8″ 58.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.33525		.0053		36,700
2	5.1298		.00115		6,700
3	7.1512	.0033		13,800	
4	8.29015	.0018		6,500	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″; exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.34055				
2	·5.1287		.00225		13,200
3	7.15055	.00265		11,100	
4 detached	8.28835				

RINGS ALL DETACHED.

2 detached	5.13095				
3 detached	7.1479				

Muzzle Slice.

Interior diameter, 4″.18; exterior diameter, 8″.58.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3345	4.3360	4.33525
2	5.1285	5.1311	5.1298
3	7.1553	7.1471	7.1512
4	8.2936	8.2867	8.29015

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3396	4.3415	4.34055
2	5.1273	5.1301	5.1287
3	7.1546	7.1465	7.15055
4 detached	8.2842	8.2925	8.28835

RINGS ALL DETACHED.

2 detached	5.1308	5.1311	5.13095
3 detached	7.1522	7.1436	7.1479

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0051	+.0055	+.0053
2 in slice	-.0012	-.0010	-.0011
3 in slice	-.0007	-.0006	-.00065
4 detached	-.0094	+.0058	-.0018

SECOND TO THIRD PHASE.

2 detached	+.0035	+.0010	+.00225
3 detached	-.0024	-.0029	-.00265

FIRST TO THIRD PHASE.

2 detached	+.0023	.0000	.00115
3 detached	-.0031	-.0035	-.0033

TUBE 11363 B_2.

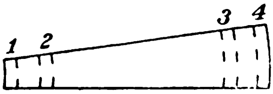
BREECH SLICE.

($\frac{5}{8}''$ discard.)

State of internal strains and stresses at different phases of the slice.

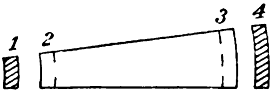
SLICE INTACT.

Interior diameter of slice, 4''.74; exterior diameter of slice, 10''.45.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.89045	....	.0066	....	40,500
2	5.65335	....	.00215	....	11,400
3	9.65065	.0036	....	11,200	....
4	10.2943	.00255	....	7,400	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5''.50; exterior diameter of slice, 9''.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.89705	....	....	....	....
2	5.65205	....	.00345	....	18,300
3	9.6498	.00275	....	8,500	....
4 detached	10.29175	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.6555	....	....	....	....
3 detached	9.64705	....	....	....	....

BREECH SLICE.

Interior diameter, 4″.74; exterior diameter, 10″.45.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8879	4.8930	4.89045
2	5.6505	5.6562	5.65335
3	9.6548	9.6465	9.65065
4	10.2984	10.2902	10.2943

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8929	4.9012	4.89705
2	5.6490	5.6551	5.65205
3	9.6539	9.6457	9.6498
4 detached	10.3005	10.2830	10.29175
RINGS ALL DETACHED.			
2 detached	5.6525	5.6585	5.6555
3 detached	9.6520	9.6421	9.64705

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0050	+.0082	+.0066
2 in slice	.0015	−.0011	−.0013
3 in slice	.0009	.0008	−.00085
4 detached	+.0021	+.0072	−.00255
SECOND TO THIRD PHASE.			
2 detached	+.0035	+.0034	+.00345
3 detached	.0019	.0036	.00275
FIRST TO THIRD PHASE.			
2 detached	+.0020	+.0023	+.00215
3 detached	.0028	.0044	.0036

TUBE 11363 B_2.

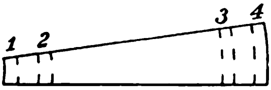
MUZZLE SLICE.

(⅝″ discard.)

State of internal strains and stresses at different phases of the slice.

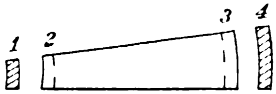
SLICE INTACT.

Interior diameter of slice, 4″.23; exterior diameter of slice, 8″.63.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3846	....	.0062	....	42,400
2	5.1539	....	.00145	....	8,400
3	7.1413	.00285	....	12,000	....
4	8.39945	.00155	....	5,500	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3908	....	....	....	....
2	5.1532	....	.00215	....	12,500
3	7.14075	.0023	....	9,700	....
4 detached	8.3979	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.15535	....	....	....	....
3 detached	7.13845	....	....	....	....

MUZZLE SLICE.

Interior diameter, 4″.23; exterior diameter, 8″.63.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3845	4.3847	4.3846
2	5.1539	5.1539	5.1539
3	7.1427	7.1399	7.1413
4	8.4095	8.3894	8.39945

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3911	4.3905	4.3908
2	5.1535	5.1529	5.1532
3	7.1425	7.1390	7.14075
4 detached	8.3943	8.4015	8.3979

RINGS ALL DETACHED.

2 detached	5.1559	5.1518	5.15535
3 detached	7.1390	7.1379	7.13845

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0066	+.0058	+.0062
2 in slice	.0004	.0010	.0007
3 in slice	.0002	-.0009	.00055
4 detached	.0152	+.0121	.00155

SECOND TO THIRD PHASE.

2 detached	+.0024	-.0019	+.00215
3 detached	.0035	-.0011	.0023

FIRST TO THIRD PHASE.

2 detached	+.0020	-.0009	+.00145
3 detached	-.0037	.0020	.00285

TUBE 11363 B_3.

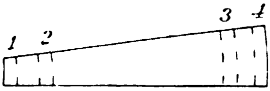
BREECH SLICE.

(⅝″ discard.)

State of internal strains and stresses at different phases of the slice.

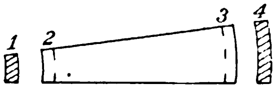
SLICE INTACT.

Interior diameter of slice, 4″.77; exterior diameter of slice, 10″.42.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9325	....	.00595	....	36,200
2	5.64955	....	.00175	....	7,200
3	9.6461	.0033	....	10,300	....
4	10.27595	.00415	....	12,100	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.93845	....	....	....	....
2	5.64835	....	.00255	....	13,500
3	9.64505	.00225	....	7,000	....
4 detached	10.2718	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.6509	....	....	....	....
3 detached	9.6428	....	....	....	....

BREECH SLICE.

Interior diameter, 4″.77; exterior diameter, 10″.42.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9320	4.9330	4.9325
2	5.6521	5.6470	5.64955
3	9.6483	9.6439	9.6461
4	10.2769	10.2750	10.27595

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9371	4.9398	4.93845
2	5.6507	5.6460	5.64835
3	9.6470	9.6431	9.64505
4 detached	10.2767	10.2669	10.2718
RINGS ALL DETACHED.			
2 detached	5.6543	5.6475	5.6509
3 detached	9.6460	9.6396	9.6428

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0051	+.0068	+.00595
2 in slice	.0014	.0010	.0012
3 in slice	−.0013	−.0008	.00105
4 detached	−.0002	−.0081	.00415
SECOND TO THIRD PHASE.			
2 detached	+.0036	+.0015	+.00255
3 detached	.0010	−.0035	−.00225
FIRST TO THIRD PHASE.			
2 detached	+.0022	+.0005	+.00135
3 detached	−.0023	−.0043	.0033

TUBE 11363 B_3.

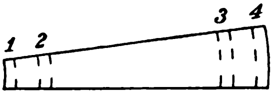
MUZZLE SLICE.

(⅝″ discard.)

State of internal strains and stresses at different phases of the slice.

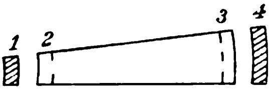
SLICE INTACT.

Internal diameter, 4″.19; external diameter, 8″.54.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1					
2	5.15215		.00015		900
3	7.1493	.0028		11,700	
4	8.3535	.00325		11,700	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3539				
2	5.1512		.0011		6,400
3	7.1187	.0022		9,200	
4 detached	8.35025				

RINGS ALL DETACHED.

2 detached	5.1523				
3 detached	7.1165				

MUZZLE SLICE.

Interior diameter, 4″.19; exterior diameter, 8″.54.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1			
2	5.1533	5.1510	5.15215
3	7.1516	7.1470	7.1493
4	8.3579	8.3491	8.3535

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3551	4.3524	4.3539
2	5.1524	5.1500	5.1512
3	7.1511	7.1463	7.1487
4 detached	8.3484	8.3521	8.35025
RINGS ALL DETACHED.			
2 detached	5.1512	5.1531	5.1523
3 detached	7.1495	7.1435	7.1465

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached			
2 in slice	−.0009	−.0010	−.00095
3 in slice	.0005	.0007	−.0006
4 detached	.0095	+.0030	−.00325
SECOND TO THIRD PHASE.			
2 detached	.0012	+.0031	+.0011
3 detached	.0016	.0028	.0022
FIRST TO THIRD PHASE.			
2 detached	.0021	+.0024	+.00015
3 detached	.0021	.0035	.0028

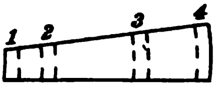
TUBE 11363 B_3.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

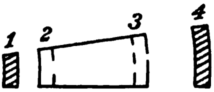
SLICE INTACT.

Interior diameter of slice, 4″.79; exterior diameter of slice, 10″.42.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.92615		.0059		35,900
2	5.6493		.00225		11,900
3	9.6457	.00385		11,600	
4	10.27855	.0024		7,000	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.93205				
2	5.64775		.0038		30,200
3	9.6447	.00285		8,900	
4 detached	10.27615				

RINGS ALL DETACHED.

2 detached	5.65155				
3 detached	9.64185				

BREECH SLICE.

Interior diameter, 4.″79; exterior diameter, 10.″42.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9273	4.9250	4.92615
2	5.6492	5.6494	5.6493
3	9.6432	9.6482	9.6457
4	10.2800	10.2771	10.27855

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9343	4.9298	4.93205
2	5.6480	5.6475	5.64775
3	9.6425	9.6469	9.6447
4 detached	10.2674	10.2849	10.27615

RINGS ALL DETACHED.

2 detached	5.6514	5.6517	5.65155
3 detached	9.6388	9.6449	9.64185

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0070	+.0048	+.0059
2 in slice	−.0012	−.0019	−.00155
3 in slice	−.0007	−.0013	−.0010
4 detached	−.0126	+.0078	−.0024

SECOND TO THIRD PHASE.

2 detached	+.0034	+.0042	+.0038
3 detached	−.0037	−.0020	−.00285

FIRST TO THIRD PHASE.

2 detached	+.0022	+.0023	+.00225
3 detached	−.0044	−.0033	−.00385

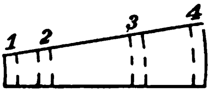
TUBE 11363 B_3.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

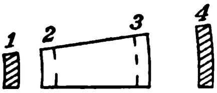
SLICE INTACT.

Interior diameter of slice, 4″.20; exterior diameter of slice, 8″.54.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3588	....	.00545	....	37,500
2	5.14995	....	.00105	....	6,100
3	7.1376	.0031	....	13,000	....
4	8.3544	.0018	....	6,500	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice 5″· exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.36425	....	....	....	....
2	5.14865	....	.00235	....	13,700
3	7.1367	.0022	....	9,200	....
4 detached	8.3526	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.1510	....	....	....	....
3 detached	7.1345	....	....	....	....

MUZZLE SLICE.

Interior diameter, 4''.20; exterior diameter, 8''.54.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3571	4.3605	4.3588
2	5.1539	5.1460	5.14995
3	7.1348	7.1404	7.1376
4	8.3627	8.3461	8.3544

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3622	4.3663	4.36425
2	5.1525	5.1448	5.14865
3	7.1339	7.1395	7.1367
4 detached	8.3680	8.3372	8.3526
RINGS ALL DETACHED.			
2 detached	5.1547	5.1473	5.1510
3 detached	7.1315	7.1375	7.1345

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	+.0051	+.0058	+.00545
2 in slice	.0014	.0012	-.0013
3 in slice	-.0009	.0009	−.0009
4 detached	+.0053	-.0089	−.0018
SECOND TO THIRD PHASE.			
2 detached	+.0022	+.0025	+.00235
3 detached	-.0024	.0020	-.0022
FIRST TO THIRD PHASE.			
2 detached	+.0008	+.0013	+.0010
3 detached	−.0033	−.0029	.0031

Tube 11467 B_1.

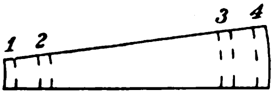
Breech Slice.

($\frac{5}{8}''$ discard.)

State of internal strains and stresses at different phases of the slice.

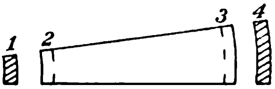
SLICE INTACT.

Interior diameter of slice, 4''.77; exterior diameter of slice, 10''.45.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9302		.0066		46,200
2	5.64985		.0022		11,700
3	9.64455	.00435		13,500	
4	10.2802	.00305		8,900	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5''.50; exterior diameter of slice, 9''.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.9368				
2	5.6485		.0035		18,900
3	9.64355	.00335		10,100	
4 detached	10.27715				

RINGS ALL DETACHED.

2 detached	5.65205				
3 detached	9.6402				

BREECH SLICE.

Interior diameter, 4″.77; exterior diameter, 10″.45.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9305	4.9299	4.9302
2	5.6510	5.6487	5.64985
3	9.6438	9.6453	9.64455
4	10.2809	10.2795	10.2802

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9371	4.9365	4.9368
2	5.6499	5.6471	5.6485
3	9.6430	9.6441	9.64355
4 detached	10.2746	10.2797	10.27715

RINGS ALL DETACHED.

2 detached	5.6535	5.6506	5.65205
3 detached	9.6401	9.6403	9.6402

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	−.0066	−.0066	+.0066
2 in slice	.0011	.0016	.00135
3 in slice	−.0008	.0012	.0010
4 detached	.0063	−.0002	.00305

SECOND TO THIRD PHASE.

2 detached	−.0036	−.0035	+.00355
3 detached	.0029	.0038	.00335

FIRST TO THIRD PHASE.

2 detached	−.0025	−.0019	−.0022
3 detached	.0037	.0050	.00435

TUBE 11467 B_1.

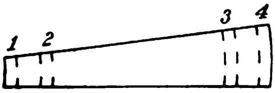
MUZZLE SLICE.

($\frac{3}{8}''$ discard.)

State of internal strains and stresses at different phases of the slice.

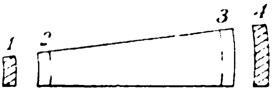
SLICE INTACT.

Interior diameter of slice, 4″.27; exterior diameter of slice, 8″.58.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.43855	....	.0059	....	39,900
2	5.15765	....	.0012	....	7,000
3	7.1580	.00325	....	13,600	....
4	8.39945	.0045	....	16,100	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.44145	....	....	....	....
2	5.1569	....	.00195	....	11,300
3	7.15755	.0028	....	11,700	....
4 detached	8.39495	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.15885	....	....	....	....
3 detached	7.15475	....	....	....	....

Muzzle Slice.

Interior diameter, 4″.27; exterior diameter, 8″.58.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.4373	4.4398	4.43855
2	5.1557	5.1596	5.15765
3	7.1560	7.1600	7.1580
4	8.4015	8.3974	8.39945

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.4429	4.4460	4.44445
2	5.1560	5.1588	5.1569
3	7.1555	7.1596	7.15755
4 detached	8.3973	8.3926	8.39495
RINGS ALL DETACHED.			
2 detached	5.1570	5.1607	5.15885
3 detached	7.1541	7.1554	7.15475

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0056	+.0062	+.0059
2 in slice	−.0007	.0008	.00075
3 in slice	−.0005	.0004	.00045
4 detached	−.0042	.0048	.0045
SECOND TO THIRD PHASE.			
2 detached	+.0020	+.0019	+.00195
3 detached	.0014	.0042	.0028
FIRST TO THIRD PHASE.			
2 detached	+.0013	+.0011	+.0012
3 detached	−.0019	.0046	−.00325

TUBE 11775 B_2.

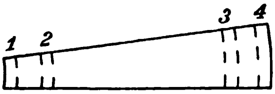
BREECH SLICE.

($\frac{3}{8}$″ discard.)

State of internal strains and stresses at different phases of the slice.

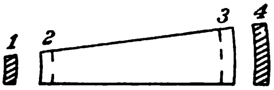
SLICE INTACT.

Interior diameter of slice, 4″.66; exterior diameter of slice, 10″.44.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.8135		.0053		33,000
2	5.65555		.00235		12,500
3	9.64545	.0038		11,800	
4	10.2820		.0006		1,700

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8188				
2	5.6539		.0040		21,200
3	9.64415	.0025		7,800	
4 detached	10.2826				

RINGS ALL DETACHED.

2 detached	5.6579				
3 detached	9.64165				

Breech Slice.

Interior diameter, 4″.66; exterior diameter, 10″.44.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8095	4.8175	4.8135
2	5.6542	5.6569	5.65555
3	9.6414	9.6495	9.64545
4	10.2802	10.2838	10.2820

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8189	4.8237	4.8188
2	5.6528	5.6550	5.6539
3	9.6402	9.6481	9.64415
4 detached	10.2687	10.2965	10.2826

RINGS ALL DETACHED.

2 detached	5.6564	5.6594	5.6579
3 detached	9.6402	9.6431	9.64165

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0044	+.0062	+.0053
2 in slice	−.0014	−.0019	−.00165
2 in slice	−.0012	−.0014	−.0018
4 detached	−.0115	+.0127	+.0006

SECOND TO THIRD PHASE.

2 detached	+.0036	+.0044	+.0040
3 detached	.0000	−.0050	−.0025

FIRST TO THIRD PHASE.

2 detached	+.0022	+.0025	+.00285
3 detached	−.0012	−.0064	−.0038

TUBE 11775 B_2.

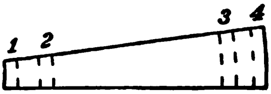
MUZZLE SLICE.

($\frac{5}{8}''$ discard.)

State of internal strains and stresses at different phases of the slice.

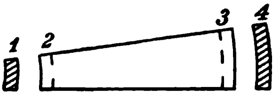
SLICE INTACT.

Interior diameter of slice, 4''.15: exterior diameter of slice, 8''.52.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.29215		.00505		35,300
2	5.1459		.00065		3,800
3	7.1537	.00335		14,000	
4	8.31525	.0051		18,400	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5''.00; exterior diameter of slice, 7''.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.2972				
2	5.1451		.00145		8,400
3	7.1530	.00265		11,100	
4 detached	8.31015				

RINGS ALL DETACHED.

2 detached	5.14655				
3 detached	7.15035				

Muzzle Slice.

Interior diameter, 4″.15; exterior diameter, 8″.52.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.2928	4.2915	4.29215
2	5.1424	5.1494	5.1459
3	7.1562	7.1512	7.1537
4	8.3191	8.3114	8.31525

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.2976	4.2968	4.2972
2	5.1415	5.1487	5.1451
3	7.1553	7.1507	7.1530
4 detached	8.3218	8.2985	8.31015

RINGS ALL DETACHED.

2 detached	5.1431	5.1500	5.14655
3 detached	7.1518	7.1489	7.15035

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0048	+.0053	+.00505
2 in slice	−.0009	−.0007	−.0008
3 in slice	−.0009	−.0005	−.0007
4 detached	+.0027	−.0129	−.0051

SECOND TO THIRD PHASE.

2 detached	+.0016	+.0013	+.00145
3 detached	−.0035	−.0018	−.00265

FIRST TO THIRD PHASE.

2 detached	+.0007	+.0006	+.00065
3 detached	−.0044	−.0023	−.00335

TUBE 11775 B_2.

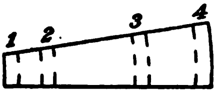
Measurements taken on four diameters.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice. Measurements on diameters A and B.

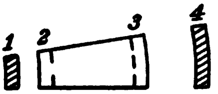
SLICE INTACT.

Interior diameter of slice, 4″.65; exterior diameter of slice, 10″.40.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.79025		.00415		26,000
2	5.6484		.0026		13,800
3	9.64295	.0045		14,000	
4	10.2296	.0016		4,700	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.7944				
2	5.64685		.00415		22,000
3	9.64195	.0035		10,900	
4 detached	10.2280				

RINGS ALL DETACHED.

2 detached	5.6510				
3 detached	9.63845				

BREECH SLICE.

Interior diameter, 4″.65; exterior diameter, 10″.40.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.7876	4.7929	4.79025
2	5.6513	5.6455	5.6484
3	9.6484	9.6425	9.64295
4	10.2256	10.2336	10.2296

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.7905	4.7983	4.7944
2	5.6500	5.6437	5.64685
3	9.6425	9.6414	9.64195
4 detached	10.2160	10.2400	10.2280

RINGS ALL DETACHED.

2 detached	5.6545	5.6475	5.6510
3 detached	9.6395	9.6374	9.63845

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0029	+.0054	+.00415
2 in slice	−.0013	−.0018	−.00155
3 in slice	−.0009	−.0011	−.0010
4 detached	−.0096	+.0064	−.0016

SECOND TO THIRD PHASE.

2 detached	+.0045	+.0038	+.00415
3 detached	−.0030	−.0040	−.0035

FIRST TO THIRD PHASE.

2 detached	+.0032	+.0020	+.0026
3 detached	−.0039	−.0051	−.0045

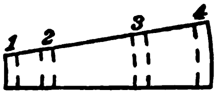
TUBE 11775 B_2.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice. Measurements on diameters C and D.

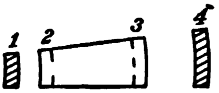
SLICE INTACT.

Interior diameter of slice, 4".65; exterior diameter of slice, 10".40.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.79795		.00365		22,800
2	5.6614		.0025		13,800
3	9.64735	.00465		14,500	
4	10.24575				

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5".5; exterior diameter of slice, 9".8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8016				
2	5.6600		.0039		20,700
3	9.6464	.0037		11,500	
4 detached	10.24575				

RINGS ALL DETACHED.

2 detached	5.6639				
3 detached	9.6427				

Breech Slice.

Interior diameter, 4″.65; exterior diameter, 10″.40.
Original diameters of rings in the slice.

Rings.	Diameters.		
	C.	D.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.7920	4.8039	4.79795
2	5.6600	5.6628	5.6614
3	9.6469	9.6478	9.64735
4	10.2482	10.2433	10.24575

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	C.	D.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.7959	4.8073	4.8016
2	5.6585	5.6615	5.6600
3	9.6460	9.6468	9.6464
4 detached	10.2528	10.2387	10.24575

RINGS ALL DETACHED.

2 detached	5.6625	5.6653	5.6639
3 detached	9.6430	9.6424	9.6427

Breech strains released.

Rings.	Diameters.		
	C.	D.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0039	+.0034	+.00365
2 in slice	−.0015	−.0013	−.0014
3 in slice	−.0009	−.0010	−.00095
4 detached	+.0046	−.0046	0.

SECOND TO THIRD PHASE.

2 detached	+.0040	+.0038	+.0039
3 detached	−.0030	−.0044	−.0037

FIRST TO THIRD PHASE.

2 detached	+.0025	+.0025	+.0025
3 detached	−.0039	−.0054	−.00465

TUBE 11775 B_2.

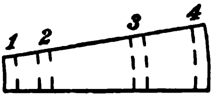
Measurements taken on four diameters.

MUZZLE SLICE.

Bore eccentric, maximum and minimum thickness on diameter C.
State of internal strains and stresses at different phases of the slice.
Measurements on diameters A and B.

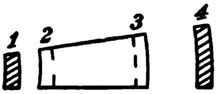
SLICE INTACT.

Interior diameter of slice, 4".16; exterior diameter of slice, 8".52.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.30145		.0061		42,600.
2	5.1457		.00185		10,800
3	7.1416	.0039		16,400	
4	8.32925		.0013		4,700

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5"; exterior diameter of slice, 7".3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.80755				
2	5.1447		.00285		16,600
3	7.14095	.00825		13,700	
4 detached	8.33055				

RINGS ALL DETACHED.

2 detached	5.14755				
3 detached	7.1377				

MUZZLE SLICE.

Interior diameter, 4″.16; exterior diameter, 8″.52.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3017	4.3012	4.30145
2	5.1436	5.1478	5.1457
3	7.1416	7.1416	7.1416
4	8.3252	8.3333	8.32925

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3089	4.3062	4.30755
2	5.1431	5.1463	5.1447
3	7.1415	7.1404	7.14095
4 detached	8.3126	8.3485	8.33055

RINGS ALL DETACHED.

2 detached	5.1450	5.1501	5.14755
3 detached	7.1386	7.1368	7.1377

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0072	+.0050	+.0061
2 in slice	−.0005	−.0015	−.0010
3 in slice	−.0001	−.0012	−.00065
4 detached	−.0126	+.0152	+.0013

SECOND TO THIRD PHASE.

2 detached	+.0019	+.0038	+.00285
3 detached	−.0029	−.0036	−.00325

FIRST TO THIRD PHASE.

2 detached	+.0014	+.0023	+.00185
3 detached	−.0030	−.0048	−.0039

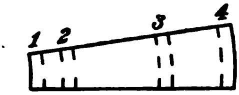
TUBE 11775 B_2.

MUZZLE SLICE.

Internal strains and stresses at different phases of the slice.
Measurements on diameters C and D.

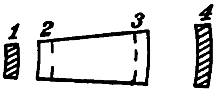
SLICE INTACT.

Interior diameter of slice, 4″.16; exterior diameter of slice, 8″.52.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.30515		.0064		44,500
2	5.1548		.00185		10,800
3	7.14855	.0037		15,500	
4	8.33885	.00785		28,200	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″; exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.31155				
2	5.1538		.00285		16,600
3	7.1479	.00305		12,800	
4 detached	8.3310				

RINGS ALL DETACHED.

2 detached	5.15665				
3 detached	7.14485				

MUZZLE SLICE.

Interior diameter, 4″.16; exterior diameter, 8″.52.
Original diameters of rings in the slice.

Rings.	Diameters.		
	C.	D.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3058	4.3045	4.30515
2	5.1550	5.1546	5.1548
3	7.1496	7.1475	7.14855
4	8.3368	8.3409	8.33885

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	C.	D.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3122	4.3109	4.31155
2	5.1543	5.1533	5.1538
3	7.1492	7.1466	7.1479
4 detached	8.3260	8.3360	8.3310

RINGS ALL DETACHED.

2 detached	5.1576	5.1557	5.15665
3 detached	7.1457	7.1440	7.14485

Muzzle strains released.

Rings.	Diameters.		
	C.	D.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0064	+.0064	+.0064
2 in slice	−.0007	−.0013	−.0010
3 in slice	−.0004	−.0009	−.00065
4 detached	−.0108	−.0049	−.00785

SECOND TO THIRD PHASE.

2 detached	+.0033	+.0024	+.00285
3 detached	−.0035	−.0026	−.00305

FIRST TO THIRD PHASE.

2 detached	+.0026	+.0011	+.00185
3 detached	−.0039	−.0035	−.0037

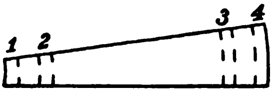
TUBE 11775 B_4 MM.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

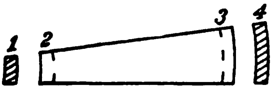
SLICE INTACT.

Interior diameter of slice, 4″.23; exterior diameter of slice, 8″.56.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3816	....	.00395	....	27,000
2	5.1454	....	.0024	....	14,000
3	7.14455	.00515	....	21,600	....
4	8.4049	.00195	....	7,000	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.38555	....	....	....	....
2	5.1449	....	.0029	....	16,900
3	7.1443	.0049	....	20,600	....
4 detached	8.40295	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.1478	....	....	....	....
3 detached	7.1394	....	....	....	....

Muzzle Slice.

Interior diameter, 4″.23; exterior diameter, 8″.56.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3799	4.3833	4.3816
2	5.1494	5.1414	5.1454
3	7.1405	7.1486	7.14455
4	8.4003	8.4095	8.4049

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3831	4.3880	4.38555
2	5.1487	5.1411	5.1449
3	7.1400	7.1486	7.1443
4 detached	8.4072	8.3987	8.40295

RINGS ALL DETACHED.

2 detached	5.1520	5.1436	5.1478
3 detached	7.1343	7.1445	7.1394

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0032	+.0047	+.00395
2 in slice	−.0007	−.0003	−.0005
3 in slice	−.0005	.0000	−.00025
4 detached	+.0069	−.0108	−.00195

SECOND TO THIRD PHASE.

2 detached	+.0023	+.0025	+.0029
3 detached	−.0057	−.0041	−.0049

FIRST TO THIRD PHASE.

2 detached	+.0026	+.0022	+.0024
3 detached	−.0062	−.0041	−.00515

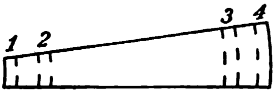
TUBE 11775 B_4 MO.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

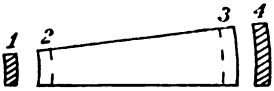
SLICE INTACT.

Interior diameter of slice, 4″.24; exterior diameter of slice, 8″.57.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3910		.00365		24,900
2	5.14985		.00265		15,400
3	7.1538	.0028		11,700	
4	8.40345	.00435		15,500	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.39465				
2	5.1497		.0028		16,300
3	7.15385	.00285		12,000	
4 detached	8.3991				

RINGS ALL DETACHED.

2 detached	5.1525				
3 detached	7.1510				

MUZZLE SLICE.

Interior diameter, 4″.24; exterior diameter, 8″.57.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3915	4.3905	4.3910
2	5.1514	5.1483	5.14985
3	7.1540	7.1536	7.1538
4	8.4069	8.4000	8.40345

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3952	4.3941	4.39465
2	5.1519	5.1475	5.1497
3	7.1548	7.1529	7.15385
4 detached	8.3988	8.3994	8.3991

RINGS ALL DETACHED.

2 detached	5.1542	5.1508	5.1525
3 detached	7.1516	7.1504	7.1510

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0037	+.0036	+.00365
2 in slice	+.0005	−.0008	−.00015
3 in slice	+.0008	−.0007	+.00005
4 detached	−.0081	−.0006	−.00435

SECOND TO THIRD PHASE.

2 detached	+.0023	+.0033	+.0028
3 detached	−.0032	−.0025	−.00285

FIRST TO THIRD PHASE.

2 detached	+.0028	+.0025	+.00265
3 detached	−.0024	−.0032	−.0028

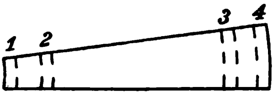
TUBE 11775 B$_4$MI.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

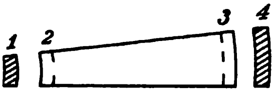
SLICE INTACT.

Interior diameter of slice, 4″.24; exterior diameter of slice, 8″.57.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.38725		.00375		25,600
2	5.1565		.0018		10,500
3	7.15455	.0021		8,800	
4	8.36605		.0019		6,800

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3910				
2	5.15575		.00255		14,800
3	7.15405	.0016		6,700	
4 detached	8.36795				

RINGS ALL DETACHED.

2 detached	5.1583				
3 detached	7.15245				

MUZZLE SLICE.

Interior diameter, 4″.24; exterior diameter, 8″.57.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3880	4.3865	4.38725
2	5.1556	5.1574	5.1565
3	7.1532	7.1559	7.15455
4	8.3652	8.3669	8.36605

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3917	4.3903	4.3910
2	5.1551	5.1564	5.15575
3	7.1530	7.1551	7.15405
4 detached	8.3544	8.3815	8.36795

RINGS ALL DETACHED.

2 detached	5.1575	5.1591	5.1583
3 detached	7.1514	7.1535	7.15245

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0037	+.0038	+.00375
2 in slice	−.0005	−.0010	−.00075
3 in slice	−.0002	−.0008	−.0005
4 detached	−.0108	+.0146	+.0019

SECOND TO THIRD PHASE.

2 detached	+.0024	+.0027	+.00255
3 detached	−.0016	−.0016	−.0016

FIRST TO THIRD PHASE.

2 detached	+.0019	+.0017	+.0018
3 detached	−.0018	−.0024	−.0021

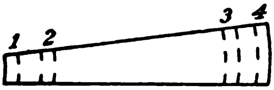
TUBE 11784 B_1.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

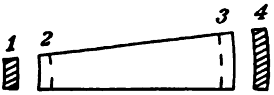
SLICE INTACT.

Interior diameter of slice, 4".75; exterior diameter of slice, 10".41.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9158		.0078		47,600
2	5.6547		.0039		20,700
3	9.65515	.0061		19,000	
4	10.2544	.00615		18,000	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5".5; exterior diameter of slice, 9".8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.9236				
2	5.6531		.0055		29,200
3	9.65415	.0051		15,800	
4 detached	10.24825				

RINGS ALL DETACHED.

2 detached	5.6586				
3 detached	9.64905				

BREECH SLICE.

Interior diameter, 4″.75; exterior diameter, 10″.41.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9147	4.9169	4.9158
2	5.6635	5.6459	5.6547
3	9.6573	9.6530	9.65515
4	10.2603	10.2485	10.2544

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9212	4.9260	4.9236
2	5.6615	5.6447	5.6531
3	9.6559	9.6524	9.65415
4 detached	10.2702	10.2263	10.24825

RINGS ALL DETACHED.

2 detached	5.6667	5.6505	5.6586
3 detached	9.6525	9.6456	9.64905

Breech strains released.

Rings.	Diameters.		Mean.
	A.	B.	
	Inch.	*Inch.*	*Inch.*
1 detached	+.0065	+.0091	+.0078
2 in slice	−.0020	−.0012	−.0016
3 in slice	−.0014	−.0006	−.0010
4 detached	+.0099	−.0222	−.00615

SECOND TO THIRD PHASE.

2 detached	+.0052	+.0058	+.0055
3 detached	−.0034	−.0068	−.0051

FIRST TO THIRD PHASE.

2 detached	+.0032	+.0046	+.0039
3 detached	−.0048	−.0074	−.0061

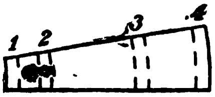
TUBE 11784 B_1.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice

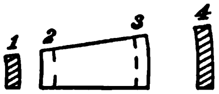
SLICE INTACT.

Interior diameter of slice, 4″.19; exterior diameter of slice, 8″.57.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.35735		.0056		38,600
2	5.14265		.0020		11,700
3	7.14775	.00355		14,900	
4	8.1140	.0061		22,600	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″; exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.36295				
2	5.1422		.00245		14,300
3	7.14765	.00345		14,500	
4 detached	8.1079				

RINGS ALL DETACHED.

2 detached	5.14465				
3 detached	7.1442				

MUZZLE SLICE.

Interior diameter, 4″.19; exterior diameter, 8″.57.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3594	4.3553	4.35735
2	5.1492	5.1361	5.14265
3	7.1485	7.1470	7.14775
4	8.1155	8.1125	8.1140

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3645	4.3614	4.36295
2	5.1483	5.1361	5.1422
3	7.1481	7.1472	7.14765
4 detached	8.1194	8.0964	8.1079

RINGS ALL DETACHED.

2 detached	5.1505	5.1388	5.14465
3 detached	7.1450	7.1434	7.1442

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0051	+.0061	+.0056
2 in slice	−.0009	.0000	−.00045
3 in slice	−.0004	+.0002	−.0001
4 detached	+.0039	−.0161	−.0061

SECOND TO THIRD PHASE.

2 detached	+.0022	+.0027	+.00245
3 detached	−.0031	−.0038	−.00345

FIRST TO THIRD PHASE.

2 detached	+.0013	+.0027	+.0020
3 detached	−.0035	−.0036	−.00355

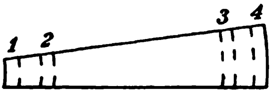
TUBE 11784 B_1.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

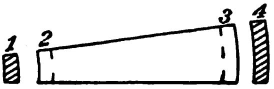
SLICE INTACT.

Interior diameter of slice, 4″.75; exterior diameter of slice, 10″.46.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.89925		.0026		15,900
2	5.65165		.0011		5,800
3	9.6469	.0011		3,400	
4	10.2760	.0015		4,400	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.90185				
2	5.6509		.00185		9,800
3	9.6468	.0010		3,100	
4 detached	10.2745				

RINGS ALL DETACHED.

2 detached	5.65275				
3 detached	9.6458				

Breech Slice.

Interior diameter, 4″.76; exterior diameter, 10″.45.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9247	4.9215	4.9231
2	5.6537	5.6448	5.64925
3	9.6500	9.6415	9.64575
4	10.2732	10.2818	10.2775

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9277	4.9240	4.92585
2	5.6528	5.6436	5.6482
3	9,6495	9.6408	9.64515
4 detached	10.2697	10.2865	10.2781

RINGS ALL DETACHED.

2 detached	5.6551	5.6480	5.65155
3 detached	9.6488	9.6370	9.6429

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0030	+.0025	+.00275
2 in slice	−.0009	−.0012	−.00105
3 in slice	−.0006	−.0007	−.0006
4 detached	−.0035	+.0047	+.0006

SECOND TO THIRD PHASE.

2 detached	+.0023	+.0044	+.00335
3 detached	−.0007	−.0038	−.00225

FIRST TO THIRD PHASE.

2 detached	+.0014	+.0032	+.0023
3 detached	−.0012	−.0045	−.00285

TUBE 11791 B_1.

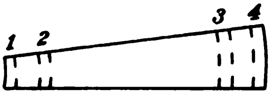
BREECH SLICE.

(⅝" discard.)

State of internal strains and stresses at different phases of the slice.

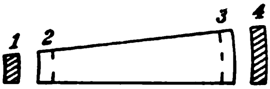
SLICE INTACT.

Interior diameter of slice, 4".81; exterior diameter of slice, 10".44.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9632		.00385		23,300
2	5.66435		.00095		5,000
3	9.65075	.0031		9,600	
4	10.2954	.00415		12,100	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5".5; exterior diameter of slice, 9".8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.96705				
2	5.66365		.00165		8,700
3	9.66045	.0028		8,700	
4 detached	10.29125				

RINGS ALL DETACHED.

2 detached	5.6653				
3 detached	9.64765				

BREECH SLICE.

Interior diameter, 4″.81; exterior diameter, 10″.44.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9587	4.9677	4.9632
2	5.6657	5.6630	5.66485
3	9.6562	9.6453	9.65075
4	10.2928	10.2980	10.2954

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9623	4.9718	4.96705
2	5.6650	5.6623	5.66365
3	9.6558	9.6451	9.65045
4 detached	10.2880	10.2945	10.29125
RINGS ALL DETACHED.			
2 detached	5.6666	5.6640	5.6653
3 detached	9.6528	9.6425	9.64765

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0036	+.0041	+.00385
2 in slice	−.0007	−.0007	−.0007
3 in slice	−.0004	−.0002	−.0003
4 detached	−.0048	−.0035	−.00415
SECOND TO THIRD PHASE.			
2 detached	+.0016	+.0017	+.00165
3 detached	−.0030	−.0026	−.0028
FIRST TO THIRD PHASE.			
2 detached	+.0009	+.0010	+.00095
3 detached	−.0034	−.0028	−.0031

TUBE 11791 B_1.

MUZZLE SLICE.

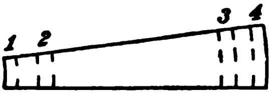
($\frac{5}{8}''$ discard.)

Bore eccentric. Ring 4, minimum thickness, ″.15; maximum thickness, ″.32.

State of internal strains and stresses at different phases of the slice.

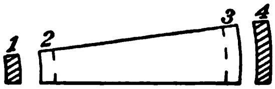
SLICE INTACT.

Interior diameter of slice, 4″.17; exterior diameter of slice, 8″.62.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.8272		.0087		25,600
2	5.14935		.00095		5,500
3	7.1444	.00275		11,500	
4	8.27855	.0082		11,600	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.0; exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8309				
2	5.14875		.00155		9,000
3	7.1439	.00225		9,400	
4 detached	8.27535				

RINGS ALL DETACHED.

2 detached	5.1503				
3 detached	7.14165				

MUZZLE SLICE.

Interior diameter, 4″.27; exterior diameter, 8″.59.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.4174	4.4203	4.41885
2	5.1375	5.1446	5.14105
3	7.1477	7.1400	7.14385
4	8.2075	8.2054	8.20645

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.4183	4.4238	4.42105
2	5.1377	5.1438	5.14075
3	7.1482	7.1395	7.14385
4 detached	8.2065	8.2050	8.20575

RINGS ALL DETACHED.

2 detached	5.1391	5.1459	5.1425
3 detached	7.1448	7.1378	7.1413

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0009	+.0035	+.0022
2 in slice	+.0002	−.0008	−.0003
3 in slice	+.0005	−.0005	.0000
4 detached	−.0010	−.0004	−.0007

SECOND TO THIRD PHASE.

2 detached	+.0014	+.0021	+.00175
3 detached	−.0034	−.0017	−.00255

FIRST TO THIRD PHASE.

2 detached	+.0016	+.0013	+.00145
3 detached	−.0029	−.0022	−.00255

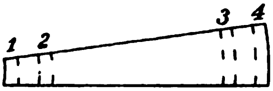
TUBE 11791 B_1.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

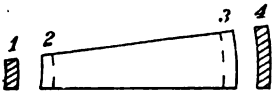
SLICE INTACT.

Interior diameter of slice, 4″.79; exterior diameter of slice, 10″.46.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.91695		.0052		31,700
2	5.64855		.00445		23,600
3	9.6499	.0048		14,900	
4	10.2825		.0012		3,500

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.92215				
2	5.6472		.0058		30,800
3	9.64915	.00405		12,600	
4 detached	10.2837				

RINGS ALL DETACHED.

2 detached	5.6530				
3 detached	9.6451				

BREECH SLICE.

Interior diameter, 4″.79; exterior diameter, 10″.46.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9149	4.9190	4.91695
2	5.6508	5.6463	5.64855
3	9.6465	9.6533	9.6499
4	10.2767	10.2883	10.2825

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9196	4.9247	4.92215
2	5.6493	5.6451	5.6472
3	9.6456	9.6527	9.64915
4 detached	10.2799	10.2875	10.2837

RINGS ALL DETACHED.

2 detached	5.6552	5.6508	5.6530
3 detached	9.6428	9.6474	9.6451

Breach strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0047	+.0057	+.0052
2 in slice	−.0015	−.0012	−.00135
3 in slice	−.0009	−.0006	−.00075
4 detached	+.0032	−.0008	+.0012

SECOND TO THIRD PHASE

2 detached	+.0059	+.0057	+.0058
3 detached	−.0028	−.0053	−.00405

FIRST TO THIRD PHASE.

2 detached	+.0044	+.0045	+.00445
3 detached	−.0037	−.0059	−.0048

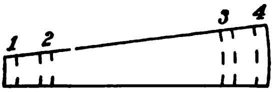
TUBE 11791 B_1.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

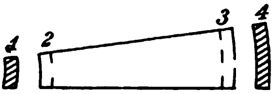
SLICE INTACT.

Interior diameter of slice, 4″.20; exterior diameter of slice, 8″.60.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3323		.00405		28,100
2	5.1447		.00275		16,100
3	7.1425	.0036		15,100	
4	8.34045	.00185		6,700	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.33635				
2	5.1440		.00345		20,100
3	7.1422	.0033		13,900	
4 detached	8.3886				

RINGS ALL DETACHED.

2 detached	5.14745				
3 detached	7.1389				

MUZZLE SLICE.

Interior diameter, 4″.20; exterior diameter, 8″.60.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3335	4.3311	4.3323
2	5.1433	5.1461	5.1447
3	7.1420	7.1430	7.1425
4	8.3406	8.3403	8.34045

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3370	4.3357	4.33635
2	5.1423	5.1457	5.1440
3	7.1414	7.1430	7.1422
4 detached	8.3444	8.3328	8.3386

RINGS ALL DETACHED.

2 detached	5.1460	5.1489	5.14745
3 detached	7.1385	7.1393	7.1389

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0035	+.0046	+.00405
2 in slice	−.0010	−.0004	−.0007
3 in slice	−.0006	.0000	−.0003
4 detached	+.0038	−.0075	−.00185

SECOND TO THIRD PHASE.

2 detached	+.0037	+.0032	+.00345
3 detached	−.0029	−.0037	−.0033

FIRST TO THIRD PHASE.

2 detached	+.0027	+.0028	+.00275
3 detached	−.0035	−.0037	−.0036

TUBE 11791 B_1.

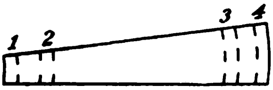
After annealing at 650° F.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

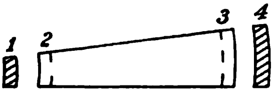
SLICE INTACT.

Interior diameter of slice, 4″.76; exterior diameter of slice, 10″.43.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.8990		.0637		22,700
2	5.64625		.0084		18,100
3	9.65745	.00305		9,500	
4	10.28535	.00055		1,600	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.9027				
2	5.6449		.00475		25,200
3	9.65675	.00235		7,300	
4 detached	10.2848				

RINGS ALL DETACHED.

2 detached	5.64865				
3 detached	9.6544				

Breech Slice.

Interior diameter, 4″.76; exterior diameter, 10″.43.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8989	4.8991	4.8990
2	5.6449	5.6476	5.64625
3	9.6606	9.6543	9.65745
4	10.2858	10.2849	10.28585

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9024	4.9030	4.9027
2	5.6433	5.6465	5.6449
3	9.6598	9.6537	9.65675
4 detached	10.2888	10.2808	10.2848

RINGS ALL DETACHED.

2 detached	5.6488	5.6505	5.64965
3 detached	9.6578	9.6510	9.6544

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0035	+.0039	+.0037
2 in slice	−.0016	−.0011	−.00135
3 in slice	−.0008	−.0006	−.0007
4 detached	+.0030	−.0041	−.00055

SECOND TO THIRD PHASE.

2 detached	+.0055	+.0040	+.00475
3 detached	−.0020	−.0027	−.00235

FIRST TO THIRD PHASE.

2 detached	+.0039	+.0029	+.0034
3 detached	−.0028	−.0033	−.00305

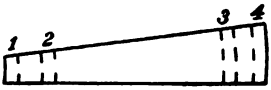
TUBE 11791 B_1.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

SLICE INTACT.

Interior diameter of slice, 4″.18; exterior diameter of slice, 8″.62.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.32185	....	.00375	....	26,000
2	5.1477	....	.0008	....	4,700
3	7.1474	.00225	....	9,400	....
4	8.37425	....	.00195	....	7,000

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.

Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3256	....	....	....	....
2	5.14675	....	.00175	....	10,200
3	7.1466	.00145	....	6,100	....
4 detached	8.3762	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.1485	....	....	....	....
3 detached	7.14515	....	....	....	....

MUZZLE SLICE.

Interior diameter, 4″.18; exterior diameter, 8″.62.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3204	4.3233	4.32185
2	5.1477	5.1477	5.1477
3	7.1488	7.1460	7.1474
4	8.3742	8.3743	8.37425

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3282	4.3280	4.3256
2	5.1468	5.1467	5.14675
3	7.1480	7.1452	7.1466
4 detached	8.3731	8.3793	8.3762

RINGS ALL DETACHED.

2 detached	5.1485	5.1485	5.1485
3 detached	7.1462	7.1441	7.14515

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0028	+.0047	+.00375
2 in slice	−.0009	−.0010	−.00095
3 in slice	−.0008	−.0008	−.0008
4 detached	−.0011	+.0050	+.00195

SECOND TO THIRD PHASE.

2 detached	+.0017	+.0018	+.00175
3 detached	−.0018	−.0011	−.00145

FIRST TO THIRD PHASE.

2 detached	+.0008	+.0008	+.0008
3 detached	−.0026	−.0019	−.00225

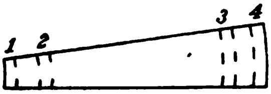
TUBE 11791 B_2.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

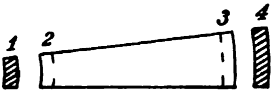
SLICE INTACT.

Interior diameter of slice, 4″.77; exterior diameter of slice, 10″.46.



Rings..	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.92875		.0072		43,800
2	5.6460		.0030		15,900
3	9.6463	.0054		16,800	
4	10.2899	.00145		4,200	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.93595				
2	5.64465		.00435		23,100
3	9.6454	.0045		14,000	
4 detached	10.28845				

RINGS ALL DETACHED.

2 detached	5.6490				
3 detached	9.6409				

BREECH SLICE.

Interior diameter, 4″.77; exterior diameter, 10″.46.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9305	4.9270	4.92875
2	5.6435	5.6485	5.6460
3	9.6475	9.6451	9.6463
4	10.2919	10.2879	10.2899

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9384	4.9335	4.93595
2	5.6426	5.6467	5.64465
3	9.6470	9.6438	9.6454
4 detached	10.2822	10.2947	10.28845

RINGS ALL DETACHED.

2 detached	5.6468	5.6512	5.6490
3 detached	9.6419	9.6399	9.6409

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0079	+.0065	+.0072
2 in slice	−.0009	−.0018	−.00135
3 in slice	−.0005	−.0013	−.0009
4 detached	−.0097	+.0068	−.00145

SECOND TO THIRD PHASE.

2 detached	+.0042	+.0045	+.00435
3 detached	−.0051	−.0039	−.0045

FIRST TO THIRD PHASE.

2 detached	+.0033	+.0027	+.0030
3 detached	−.0056	−.0052	−.0054

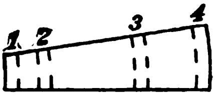
TUBE 11791 B$_2$.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

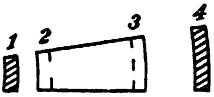
SLICE INTACT.

Interior diameter of slice, 4″.29; exterior diameter of slice, 8″.50.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.4610		.0063		42,400
2	5.14595		.0028		16,300
3	7.1545	.00485		20,300	
4	8.2988	.00155		5,600	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″: exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.4673				
2	5.14565		.0031		18,100
3	7.15435	.0047		19,700	
4 detached	8.29725				

RINGS ALL DETACHED.

2 detached	5.14875				
3 detached	7.14965				

MUZZLE SLICE.

Interior diameter, 4″.29; exterior diameter, 8″.50.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.4655	4.4565	4.4610
2	5.1439	5.1480	5.14595
3	7.1494	7.1596	7.1545
4	8.3020	8.2956	8.2988

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.4716	4.4630	4.4673
2	5.1433	5.1480	5.14565
3	7.1489	7.1598	7.15435
4 detached	8.3043	8.2902	8.29725

RINGS ALL DETACHED.

2 detached	5.1502	5.1473	5.14875
3 detached	7.1442	7.1551	7.14965

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0061	+.0065	+.0063
2 in slice	−.0006	.0000	−.0003
3 in slice	−.0005	+.0002	−.00015
4 detached	+.0023	−.0054	−.00155

SECOND TO THIRD PHASE.

2 detached	+.0069	−.0007	+.0031
3 detached	−.0047	−.0047	−.0047

FIRST TO THIRD PHASE.

2 detached	+.0063	−.0007	+.0028
3 detached	−.0052	−.0045	−.00485

TUBE 11794 B_5.

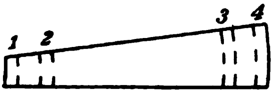
BREECH SLICE.

(⅝″ discard.)

State of internal strains and stresses at different phases of the slice.

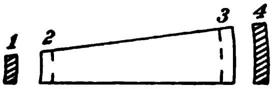
SLICE INTACT.

Interior diameter of slice, 4″.75; exterior diameter of slice, 10″.45.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9100		.0051		31,200
2	5.65855		.00145		7,700
3	9.6488	.00405		12,600	
4	10.2982	.00155		4,500	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.9151				
2	5.6528		.0027		14,300
3	4.64775	.0030		9,300	
4 detached	10.29665				

RINGS ALL DETACHED.

2 detached	5.6550				
3 detached	9.64475				

BREECH SLICE.

Interior diameter, 4″.75; exterior diameter, 10″.45.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9081	4.9119	4.9100
2	5.6501	5.6570	5.65355
3	9.6478	9.6498	9.6488
4	10.2948	10.3016	10.2982

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9116	4.9186	4.9151
2	5.6485	5.6561	5.6523
3	9.6465	9.6490	9.64775
4 detached	10.3065	10.2868	10.29665

RINGS ALL DETACHED.

2 detached	5.6516	5.6584	5.6550
3 detached	9.6469	9.6426	9.64475

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0035	+.0067	+.0051
2 in slice	−.0016	−.0009	−.00125
3 in slice	−.0013	−.0008	−.00105
4 detached	+.0117	−.0148	−.00155

SECOND TO THIRD PHASE.

2 detached	+.0031	+.0023	+.0027
3 detached	+.0004	−.0064	−.0030

FIRST TO THIRD PHASE.

2 detached	+.0015	+.0014	+.00145
3 detached	−.0009	−.0072	−.00405

TUBE 11794 B_5.

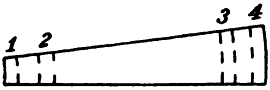
MUZZLE SLICE.

($\frac{5}{8}''$ discard.)

State of internal strains and stresses at different phases of the slice.

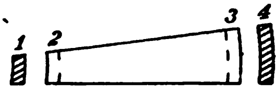
SLICE INTACT.

Interior diameter of slice, 4″.17; exterior diameter of slice, 8″.53.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.34275		.0047		32,500
2	5.15605	.00025		1,400	
3	7.1504	.0021		8,800	
4	8.3875	.00505		18,100	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.0; exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.34745				
2	5.15505		.00075		4,400
3	7.1497	.0014		5,900	
4 detached	8.38245				

RINGS ALL DETACHED.

2 detached	5.1558				
3 detached	7.1483				

MUZZLE SLICE.

Interior diameter, 4".17; exterior diameter, 8".53.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3436	4.3419	4.34275
2	5.1572	5.1549	5.15605
3	7.1492	7.1516	7.1504
4	8.3899	8.3851	8.3875

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3484	4.3465	4.34745
2	5.1562	5.1539	5.15505
3	7.1484	7.1510	7.1497
4 detached	8.3886	8.3813	8.38245
RINGS ALL DETACHED.			
2 detached	5.1567	5.1549	5.1558
3 detached	7.1472	7.1494	7.1483

Muzzle strains releas

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0048	+.0046	+.0047
2 in slice	−.0010	−.0010	−.0010
3 in slice	−.0008	−.0006	−.0007
4 detached	−.0063	−.0038	−.00505
SECOND TO THIRD PHASE.			
2 detached	+.0005	+.0010	+.00075
3 detached	−.0012	−.0016	−.0014
FIRST TO THIRD PHASE.			
2 detached	−.0005	.0000	−.00025
3 detached	−.0020	−.0022	−.0021

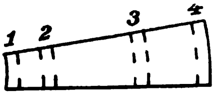
TUBE 11794 B_5.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

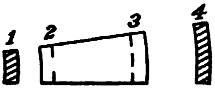
SLICE INTACT.

Interior diameter of slice, 4″.77; exterior diameter of slice, 10″.41.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9221		.0077		47,000
2	5.64085		.0044		23,400
3	9.64315	.00695		21.600	
4	10.2678	.0027		7,900	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.9298				
2	5.63945		.0058		30,900
3	9.6420	.0058		18,000	
4 detached	10.2651				

RINGS ALL DETACHED.

2 detached	5.64525				
3 detached	9.6362				

BREECH SLICE.

Interior diameter, 4″.77; exterior diameter, 10″.41
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9297	4.9145	4.9221
2	5.6396	5.6421	5.64085
3	9.6374	9.6489	9.64315
4	10.2711	10.2645	10.2678

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9372	4.9224	4.9298
2	5.6380	5.6409	5.63945
3	9.6358	9.6482	9.6420
4 detached	10.2759	10.2543	10.2651

RINGS ALL DETACHED.

2 detached	5.6441	5.6464	5.64525
3 detached	9.6285	9.6439	9.6362

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detach.	+.0075	+.0079	+.0077
2 in slice	−.0016	−.0012	−.0014
3 in slice	−.0016	−.0007	−.00115
4 detached	+.0048	−.0102	−.0027

SECOND TO THIRD PHASE.

2 detached	+.0061	+.0055	+.0058
3 detached	−.0073	−.0043	−.0058

FIRST TO THIRD PHASE.

2 detached	+.0045	+.0043	+.0044
3 detached	−.0089	−.0050	−.00695

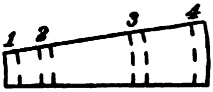
TUBE 11794 B_5.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

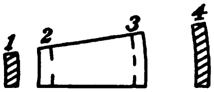
SLICE INTACT.

Interior diameter of slice, 4″.27: exterior diameter of slice, 8″.53.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.30715		.00605		42,100
2	5.1409		.00085		5,000
3	7.1489	.00345		14,500	
4	8.34595		.00065		2,300

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of the slice, 5″; exterior diameter of the slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3132				
2	5.1398		.00195		11,400
3	7.14815	.0027		11,300	
4 detached	8.3466				

RINGS ALL DETACHED.

2 detached	5.14175				
3 detached	7.14545				

MUZZLE SLICE.

Interior diameter, 4″.27; exterior diameter, 8″.53.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3062	4.3091	4.30715
2	5.1373	5.1445	5.1409
3	7.1509	7.1469	7.1489
4	8.3462	8.3457	8.34595

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3110	4.3154	4.3132
2	5.1355	5.1441	5.1398
3	7.1495	7.1468	7.14815
4 detached	8.3642	8.3290	8.3466

RINGS ALL DETACHED.

2 detached	5.1381	5.1454	5.14175
3 detached	7.1468	7.1441	7.14545

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0058	+.0063	+.00605
2 in slice	−.0018	−.0004	−.0011
3 in slice	−.0014	−.0001	−.00075
4 detached	+.0180	−.0167	+.00065

SECOND TO THIRD PHASE.

2 detached	+.0026	+.0018	+.00195
3 detached	−.0027	−.0027	−.0027

FIRST TO THIRD PHASE.

2 detached	+.0008	+.0009	+.00085
3 detached	−.0041	−.0028	−.00345

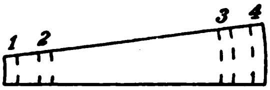
Tube 11794 B_5.

Breech Slice.

After annealing 7 feet of breech end at 665° F.
State of internal strains and stresses at different phases of the slice.

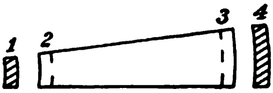
SLICE INTACT.

Interior diameter of slice, 4″.76; exterior diameter of slice, 10″.44.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.89685		.0042		25,700
2	5.6485		.00295		15,700
3	9.65925	.00295		9,200	
4	10.2881	.0013		3,800	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.90105				
2	5.64725		.0042		22,300
3	9.6583	.0020		6,200	
4 detached	10.2868				

RINGS ALL DETACHED.

2 detached	5.65145				
3 detached	9.6563				

BREECH SLICE.

Interior diameter, 4″.76; exterior diameter, 10″.44.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8936	4.9001	4.89685
2	5.6470	5.6500	5.6485
3	9.6596	9.6589	9.65925
4	10.2943	10.2819	10.2881

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8975	4.9046	4.90105
2	5.6455	5.6490	5.64725
3	9.6585	9.6581	9.6583
4 detached	10.2898	10.2838	10.2868

RINGS ALL DETACHED.

2 detached	5.6499	5.6530	5.65145
3 detached	9.6574	9.6552	9.6563

Breech strains released.

Rings.	Diameters.		
	A	B	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0039	+.0045	+.0042
2 in slice	−.0015	−.0010	−.00125
3 in slice	−.0011	−.0008	−.00095
4 detached	−.0045	+.0019	−.0013

SECOND TO THIRD PHASE.

2 detached	+.0044	+.0040	+.0042
3 detached	−.0011	−.0029	−.0020

FIRST TO THIRD PHASE.

2 detached	+.0029	+.0030	+.00295
3 detached	−.0022	−.0037	−.00295

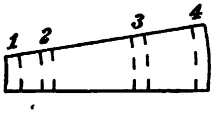
TUBE 11837 B_3.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

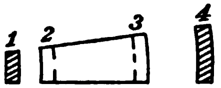
SLICE INTACT.

Interior diameter of slice, 4″.73; exterior diameter of slice, 10″.43.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.88695	....	.00905	....	55,500
2	5.6467	....	.00485	....	25,800
3	9.6528	.0068	....	21,100	....
4	10.26475	.0030	....	8,800	....

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8960	....	....	....	....
2	5.6450	....	.00655	....	34,800
3	9.6517	.0057	....	17,700	....
4 detached	10.26175	....	....	....	....

RINGS ALL DETACHED.

2 detached	5.65155	....	....	....	....
3 detached	9.6460	....	....	....	....

Breech Slice.

Interior diameter, 4″.73; exterior diameter, 10″.43.
Original diameters of rings in the slice.

Ring.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8879	4.8860	4.88695
2	5.6489	5.6445	5.6467
3	9.6576	9.6480	9.6528
4	10.2730	10.2565	10.26475

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8975	4.8945	4.8960
2	5.6472	5.6428	5.6450
3	9.6565	9.6469	9.6517
4 detached	10.2675	10.2560	10.26175

RINGS ALL DETACHED.

2 detached	5.6536	5.6495	5.65155
3 detached	9.6534	9.6386	9.6460

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0096	+.0085	+.00905
2 in slice	−.0017	−.0017	−.0017
3 in slice	−.0011	−.0011	−.0011
4 detached	−.0055	−.0005	−.0030

SECOND TO THIRD PHASE.

2 detached	+.0064	+.0067	+.00655
3 detached	−.0031	−.0083	−.0057

FIRST TO THIRD PHASE.

2 detached	+.0047	+.0050	+.00485
3 detached	−.0042	−.0094	−.0068

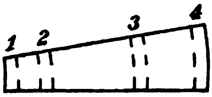
TUBE 11837 B_3.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

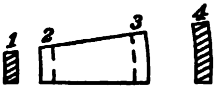
SLICE INTACT.

Interior diameter of slice, 4″.15; exterior diameter of slice, 8″.57.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.3006		.0025		17,400
2	5.1481		.0005		2,900
3	7.1457	.00175		7,300	
4	8.2431		.0018		6,600

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″; exterior diameter of slice, 7″.3.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3031				
2	5.1477		.0009		5,200
3	7.1454	.00145		6,100	
4 detached	8.2449				

RINGS ALL DETACHED.

2 detached	5.1486				
3 detached	7.14396				

MUZZLE SLICE.

Interior diameter, 4".15; exterior diameter, 8".57.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3006	4.3006	4.3006
2	5.1461	5.1501	5.1481
3	7.1458	7.1456	7.1457
4	8.2470	8.2392	8.2431

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3036	4.3026	4.3031
2	5.1457	5.1497	5.1477
3	7.1455	7.1453	7.1454
4 detached	8.2466	8.2432	8.2449

RINGS ALL DETACHED.

2 detached	5.1458	5.1514	5.1486
3 detached	7.1445	7.1434	7.14395

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0030	+.0020	+.0025
2 in slice	−.0004	−.0004	−.0004
3 in slice	−.0003	−.0003	−.0003
4 detached	−.0004	+.0040	+.0018

SECOND TO THIRD PHASE.

2 detached	+.0001	+.0017	+.0009
3 detached	−.0010	−.0019	−.00145

FIRST TO THIRD PHASE.

2 detached	−.0003	+.0013	+.0005
3 detached	−.0013	−.0022	−.00175

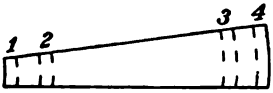
TUBE 11837 B_3.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

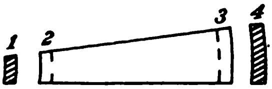
SLICE INTACT.

Interior diameter of slice, 4″.74; exterior diameter of slice, 10″.42.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.86745		.00585		36,100
2	5.6475		.0032		17,000
3	9.64395	.0046		14,300	
4	10.26005	.0041		12,000	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8733				
2	5.6463		.0044		23,400
3	9.6431	.00375		11,700	
4 detached	10.25595				

RINGS ALL DETACHED.

2 detached	5.6507				
3 detached	9.63935				

Breech Slice.

Interior diameter, 4″.74; exterior diameter, 10″.42.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8660	4.8689	4.86745
2	5.6479	5.6471	5.6475
3	9.6466	9.6413	9.64395
4	10.2628	10.2573	10.26005

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8719	4.8747	4.8733
2	5.6464	5.6462	5.6463
3	9.6455	9.6407	9.6431
4 detached	10.2666	10.2453	10.25595

RINGS ALL DETACHED.

2 detached	5.6509	5.6505	5.6507
3 detached	9.6417	9.6370	9.63935

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0059	+.0058	+.00585
2 in slice	−.0015	−.0009	−.0012
3 in slice	−.0011	−.0006	−.00085
4 detached	+.0038	−.0120	−.0041

SECOND TO THIRD PHASE.

2 detached	+.0045	+.0043	+.0044
3 detached	−.0038	−.0037	−.00375

FIRST TO THIRD PHASE.

2 detached	+.0030	+.0034	+.0032
3 detached	−.0049	−.0043	−.0046

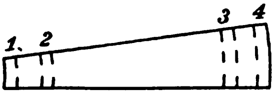
TUBE 11837 B_3.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

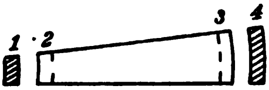
SLICE INTACT.

Interior diameter of slice, 4″.14; exterior diameter of slice, 8″.56.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.2626		.0064		45,000
2	5.1400		.0022		12,800
3	7.14215	.0039		16,400	
4	8.2721	.0059		21,400	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.2690				
2	5.13915		.00305		17,800
3	7.1417	.00345		14,500	
4 detached	8.2662				

RINGS ALL DETACHED.

2 detached	5.1422				
3 detached	7.13825				

MUZZLE SLICE.

Interior diameter, 4″.14; exterior diameter, 8″.56.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.2630	4.2622	4.2626
2	5.1398	5.1402	5.1400
3	7.1408	7.1435	7.14215
4	8.2751	8.2691	8.2721

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.2688	4.2692	4.2690
2	5.1389	5.1394	5.13915
3	7.1405	7.1429	7.1417
4 detached	8.2673	8.2651	8.2662

RINGS ALL DETACHED.

2 detached	5.1412	5.1432	5.1422
3 detached	7.1358	7.1407	7.13825

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0058	+.0070	+.0064
2 in slice	−.0009	−.0008	−.00085
3 in slice	−.0003	−.0006	−.00045
4 detached	−.0078	−.0040	−.0059

SECOND TO THIRD PHASE.

2 detached	+.0023	+.0038	+.00305
3 detached	−.0047	−.0022	−.00345

FIRST TO THIRD PHASE.

2 detached	+.0014	+.0030	+.0022
3 detached	−.0050	−.0028	−.0039

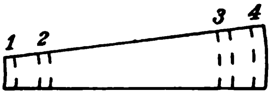
TUBE 12485 B_7 BI.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

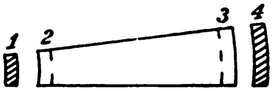
SLICE INTACT.

Interior diameter of slice, 4″.76; exterior diameter of slice, 10″.41.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.90375		.0048		29,300
2	5.64935		.00275		14.600
3	9.65175	.0040		12,400	
4	10.2799	.0039		11,400	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.90855				
2	5.6481		.0040		21,200
3	9.65105	.0033		10,300	
4 detached	10.2760				

RINGS ALL DETACHED.

2 detached	5.6521				
3 detached	9.64775				

Breech Slice.

Interior diameter, 4″.76; exterior diameter, 10″.41
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9024	4.9051	4.90375
2	5.6507	5.6480	5.64935
3	9.6518	9.6517	9.65175
4	10.2865	10.2733	10.2799

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9074	4.9097	4.90855
2	5.6493	5.6469	5.6481
3	9.6510	9.6511	9.65105
4 detached	10.2933	10.2587	10.2760

RINGS ALL DETACHED.

2 detached	5.6583	5.6509	5.6521
3 detached	9.6492	9.6463	9.64775

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0050	+.0046	+.0048
2 in slice	−.0014	−.0011	−.00125
3 in slice	−.0008	−.0006	−.0007
4 detached	+.0068	−.0146	−.0039

SECOND TO THIRD PHASE.

2 detached	+.0040	+.0040	+.0040
3 detached	−.0018	−.0048	−.0033

FIRST TO THIRD PHASE.

2 detached	+.0026	+.0029	+.00275
3 detached	−.0026	−.0054	−.0040

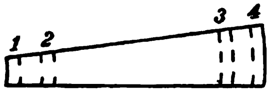
TUBE 12485 B_7 BM.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

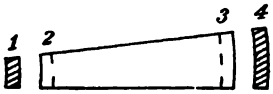
SLICE INTACT.

Interior diameter of slice, 4".74; exterior diameter of slice, 10".41.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9329		.00425		25,800
2	5.6479		.0033		17,500
3	9.6454	.00425		18,200	
4	10.2664	.00485		14,200	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5".50; exterior diameter of slice, 9".80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.93715				
2	5.6470		.0042		22,300
3	9.64475	.0036		11,200	
4 detached	10.26155				

RINGS ALL DETACHED.

2 detached	5.6512				
3 detached	9.64115				

BREECH SLICE.

Interior diameter, 4″.74; exterior diameter, 10″.41.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9318	4.9345	4.9329
2	5.6434	5.6524	5.6479
3	9.6383	9.6525	9.6454
4	10.2654	10.2674	10.2654

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9359	4.9384	4:93715
2	5.6425	5.6515	5.6470
3	9.6375	9.6520	9.64475
4 detached	10.2600	10.2631	10.26155

RINGS ALL DETACHED.

2 detached	5.6468	5.6556	5.6512
3 detached	9.6320	9.6503	9.64115

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0046	+.0039	+.00425
2 in slice	−.0009	−.0009	−.0009
3 in slice	−.0008	−.0005	−.00065
4 detached	−.0054	−.0043	−.00485

SECOND TO THIRD PHASE.

2 detached	+.0043	+.0041	+.0042
3 detached	−.0055	−.0017	−.0036

FIRST TO THIRD PHASE.

2 detached	+.0034	+.0032	+.0033
3 detached	−.0063	−.0022	−.00425

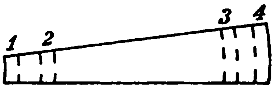
TUBE 12485 B, BI—A.

BREECH SLICE.

Annealed at 750° F.
State of internal strains and stresses at different phases of the slice.

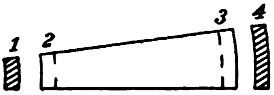
SLICE INTACT.

Interior diameter of slice, 4″.74; exterior diameter of slice, 10″.41.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	Inch.	Inch.	Pounds.	Pounds.
1	4.8954		.0033		20,200
2	5.6465		.0021		11,200
3	9.6481	.0016		5,000	
4	10.2575	.0003		900	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	Inch.	Inch.	Pounds.	Pounds.
1 detached	4.8987				
2	5.6457		.0029		15,400
3	9.6477	+.0012		3,700	
4 detached	10.2572				

RINGS ALL DETACHED.

2 detached	5.6486				
3 detached	9.6465				

BREECH SLICE.

Interior diameter, 4″.74; exterior diameter, 10″.41.
Original diameters of rings in the slice.

Rings	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8955	4.8953	4.8954
2	5.6466	5.6464	5.6465
3	9.6508	9.6454	9.6481
4	10.2605	10.2545	10.2575

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8988	4.8986	4.8987
2	5.6459	5.6455	5.6457
3	9.6505	9.6449	9.6477
4 detached	10.2586	10.2558	10.2572

RINGS ALL DETACHED.

2 detached	5.6487	5.6485	5.6486
3 detached	9.6470	9.6460	9.6465

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0033	+.0033	+.0033
2 in slice	−.0007	−.0009	−.0008
3 in slice	−.0003	−.0005	−.0004
4 detached	−.0019	+.0013	−.0003

SECOND TO THIRD PHASE.

2 detached	+.0028	+.0030	+.0029
3 detached	−.0035	+.0011	−.0012

FIRST TO THIRD PHASE.

2 detached	+.0021	+.0021	+.0021
3 detached	−.0038	+.0006	−.0016

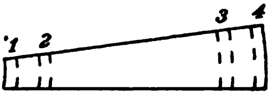
TUBE 12485 B_7, BM—A.

BREECH SLICE.

Annealed at 600° F.
State of internal strains and stresses at different phases of the slice.

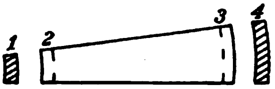
SLICE INTACT.

Interior diameter of slice, 4″.78; exterior diameter of slice, 10″.41.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.95285		.00435		26,300
2	5.6496		.00265		14,100
3	9.64505	.00405		12,600	
4	10.26705		.00155		4,500

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.9572				
2	5.6486		.00365		19,400
3	9.64435	.00335		10,400	
4 detached	10.2686				

RINGS ALL DETACHED.

2 detached	5.65225				
3 detached	9.6410				

Breech Slice.

Interior diameter, 4″.78; exterior diameter, 10″.41.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9494	4.9563	4.95285
2	5.6469	5.6523	5.6496
3	9.6446	9.6455	9.64505
4	10.2652	10.2689	10.26705

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9540	4.9604	4.9572
2	5.6459	5.6513	5.6486
3	9.6438	9.6449	9.64435
4 detached	10.2667	10.2705	10.2686

RINGS ALL DETACHED.

2 detached	5.6498	5.6547	5.65225
3 detached	9.6374	9.6446	9.6410

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0046	+.0041	+.00435
2 in slice	−.0010	−.0010	−.0010
3 in slice	−.0008	−.0006	−.0007
4 detached	+.0015	+.0016	+.00155

SECOND TO THIRD PHASE.

2 detached	+.0039	+.0034	+.00365
3 detached	−.0064	−.0003	−.00335

FIRST TO THIRD PHASE.

2 detached	+.0029	+.0024	+.00265
3 detached	−.0072	−.0009	−.00405

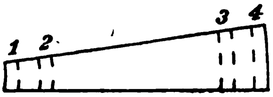
Tube 12485 B_7, BO—A

Breech Slice.

Annealed at 450° F.
State of internal strains and stresses at different phases of the slice.

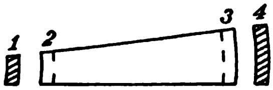
SLICE INTACT.

Interior diameter of slice, 4″.80; exterior diameter of slice, 10″.42.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.9465		.00385		23,300
2	5.6447		.00275		14,600
3	9.6462	.0020		6,200	
4	10.27055		.0047		13,700

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.5; exterior diameter of slice, 9″.8.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1, detached	4.95035				
2	5.64345		.0040		21,200
3	9.6454	.0012		3,700	
4 detached	10.27525				

RINGS ALL DETACHED.

2 detached	5.64745				
3 detached	9.6442				

BREECH SLICE.

Interior diameter, 4″.80; exterior diameter, 10″.42.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.9504	4.9426	4.9465
2	5.6446	5.6448	5.6447
3	9.6430	9.6494	9.6462
4	10.2726	10.2685	10.27055

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.9541	4.9466	4.95035
2	5.6432	5.6437	5.64345
3	9.6422	9.6486	9.6454
4 detached	10.2818	10.2687	10.27525
RINGS ALL DETACHED.			
2 detached	5.6474	5.6475	5.64745
3 detached	9.6430	9.6454	9.6442

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0037	+.0040	+.00385
2 in slice	−.0014	−.0011	−.00125
3 in slice	−.0008	−.0008	−.0008
4 detached	+.0092	+.0002	+.0047
SECOND TO THIRD PHASE.			
2 detached	+.0042	+.0038	+.0040
3 detached	+.0008	−.0032	−.0012
FIRST TO THIRD PHASE.			
2 detached	+.0028	+.0027	+.00275
3 detached	.0000	−.0040	−.0020

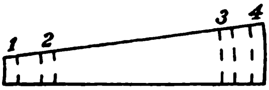
TUBE 20691 B_3.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

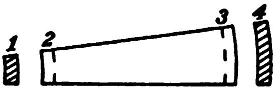
SLICE INTACT.

Interior diameter of slice, 4″.73; exterior diameter of slice, 10″.50.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.8763		.00555		34,100
2	5.64665		.0012		6,400
3	9.64915	.00315		9,800	
4	10.3184		.0007		2,000

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.88185				
2	5.64565		.0022		11,700
3	9.6484	.0024		7,500	
4 detached	10.3191				

RINGS ALL DETACHED.

2 detached	5.64785				
3 detached	9.6460				

BREECH SLICE.

Interior diameter. 4″.73; exterior diameter, 10″.50.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches,	*Inches.*	*Inches.*
1	4.8743	4.8783	4.8763
2	5.6440	5.6493	5.64665
3	9.6499	9.6484	9.64915
4	10.3145	10.3223	10.3184

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8802	4.8835	4.88185
2	5.6430	5.6483	5.64565
3	9.6492	9.6476	9.6484
4 detached	10.3099	10.3283	10.3191

RINGS ALL DETACHED.

2 detached	5.6450	5.6507	5.64785
3 detached	9.6460	9.6460	9.6460

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0059	+.0052	+.00555
2 in slice	−.0010	−.0010	−.0010
3 in slice	−.0007	−.0008	−.00075
4 detached	−.0046	+.0060	+.0007

SECOND TO THIRD PHASE.

2 detached	+.0020	+.0024	+.0022
3 detached	−.0032	−.0016	−.0024

FIRST TO THIRD PHASE.

2 detached	+.0010	+.0014	+.0012
3 detached	−.0039	−.0024	−.00315

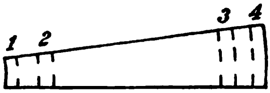
TUBE 20691 B_3.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

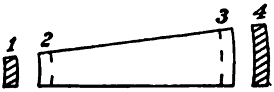
SLICE INTACT.

Interior diameter of slice, 4″.23; exterior diameter of slice, 9″.07.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.37615		.0063		43,200
2	5.13895		.0009		5,300
3	7.16515	.00205		8,600	
4	8.90525	.00095		3,200	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.38245				
2	5.13865		.0012		7,000
3	7.1651	.0020		8,400	
4 detached	8.9043				

RINGS ALL DETACHED.

2 detached	5.13985				
3 detached	7.1631				

MUZZLE SLICE.

Interior diameter of slice, 4″.23; exterior diameter of slice, 9″.07. Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3795	4.3728	4.37615
2	5.1419	5.1360	5.13895
3	7.1636	7.1667	7.16515
4	8.9069	8.9036	8.90525

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3854	4.3795	4.38245
2	5.1417	5.1356	5.13865
3	7.1636	7.1666	7.1651
4 detached	8.9030	8.9056	8.9043

RINGS ALL DETACHED.

2 detached	5.1444	5.1353	5.13985
3 detached	7.1611	7.1651	7.1631

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0059	+.0067	+.0063
2 in slice	−.0002	−.0004	−.0003
3 in slice	.0000	−.0001	−.00005
4 detached	−.0039	+.0020	−.00095

SECOND TO THIRD PHASE.

2 detached	+.0027	−.0003	+.0012
3 detached	−.0025	−.0015	−.0020

FIRST TO THIRD PHASE.

2 detached	+.0025	−.0007	+.0009
3 detached	−.0025	−.0016	−.00205

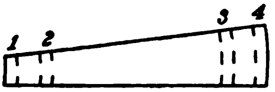
TUBE 20691 B_3.

BREECH SLICE.

State of internal strains and stresses at different phases of the slice.

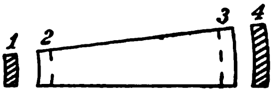
SLICE INTACT.

Interior diameter of slice, 4″.72; exterior diameter of slice, 10″.50.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.8717		.0073		45,000
2	5.6539		.00355		18,800
3	9.64745	.0056		17,400	
4	10.3323		.00045		1,300

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.50; exterior diameter of slice, 9″.80.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.8790				
2	5.6523		.00515		27,300
3	9.64635	.0045		14,000	
4 detached	10.33275				

RINGS ALL DETACHED.

2 detached	5.65745				
3 detached	9.64185				

BREECH SLICE.

Interior diameter, 4″.72; exterior diameter, 10″.50.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.8725	4.8709	4.8717
2	5.6587	5.6491	5.6539
3	9.6534	9.6415	9.64745
4	10.3355	10.3291	10.3323

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.8801	4.8779	4.8790
2	5.6568	5.6478	5.6523
3	9.6519	9.6408	9.64635
4 detached	10.3450	10.3205	10.33275

RINGS ALL DETACHED.

2 detached	5.6620	5.6529	5.65745
3 detached	9.6479	9.6358	9.64185

Breech strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0076	+.0070	+.0073
2 in slice	−.0019	−.0013	−.0016
3 in slice	−-.0015	−.0007	−.0011
4 detached	+.0095	−.0086	+.00045

SECOND TO THIRD PHASE.

2 detached	+.0052	+.0051	+.00515
3 detached	−.0040	−.0050	−.0045

FIRST TO THIRD PHASE.

2 detached	+.0033	+.0038	+.00355
3 detached	−.0055	−.0057	−.0056

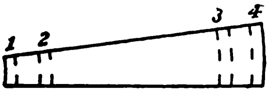
TUBE 20691 B_3.

MUZZLE SLICE.

State of internal strains and stresses at different phases of the slice.

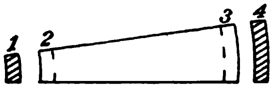
SLICE INTACT.

Interior diameter of slice, 4″.25; exterior diameter of slice, 9″.01.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	4.39405		.00225		15,400
2	5.1509		.0026		15,100
3	7.14615	.0012		5,000	
4	8.8594	.0041		13,900	

Rings 1 and 4 detached; rings 2 and 3 in the slice.
Interior diameter of slice, 5″.00; exterior diameter of slice, 7″.30.



Rings.	Present mean diameters.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1 detached	4.3963				
2	5.15105		.00245		14,300
3	7.1470	.00205		8,600	
4 detached	8.8553				

RINGS ALL DETACHED.

2 detached	5.1535				
3 detached	7.14495				

MUZZLE SLICE.

Interior diameter, 4″.25; exterior diameter, 9″.01.
Original diameters of rings in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	4.3908	4.3973	4.39405
2	5.1490	5.1528	5.1509
3	7.1408	7.1515	7.14615
4	8.8612	8.8576	8.8594

Rings 1 and 4 detached; rings 2 and 3 in the slice.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1 detached	4.3934	4.3992	4.3963
2	5.1492	5.1529	5.15105
3	7.1417	7.1523	7.1470
4 detached	8.8613	8.8493	8.8553

RINGS ALL DETACHED.

2 detached	5.1520	5.1550	5.1535
3 detached	7.1395	7.1504	7.14495

Muzzle strains released.

Rings.	Diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
1 detached	+.0026	+.0019	+.00225
2 in slice	+.0002	+.0001	+.00015
3 in slice	+.0009	+.0008	+.00085
4 detached	+.0001	−.0083	−.0041

SECOND TO THIRD PHASES.

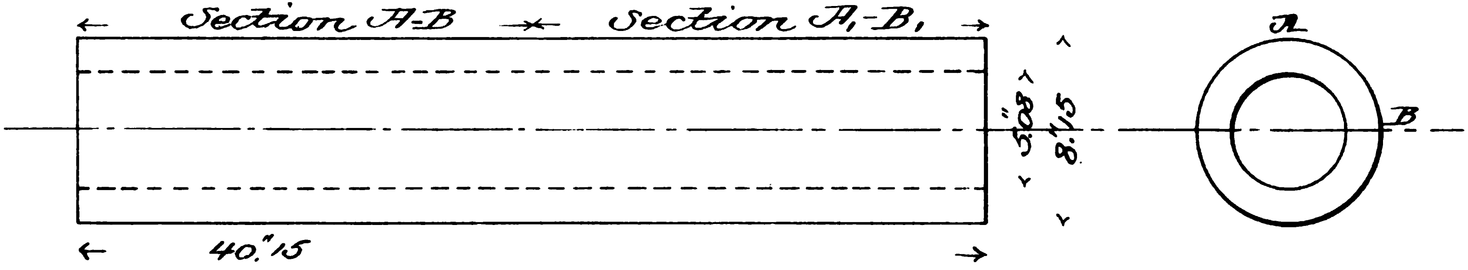
2 detached	+.0028	+.0021	+.00245
3 detached	−.0022	−.0019	−.00205

FIRST TO THIRD PHASE.

2 detached	+.0030	+.0022	+.0026
3 detached	−.0013	−.0011	−.0012

INTERNAL STRAINS IN A STEEL TUBE AFTER TREATMENT.

Internal Strains
in a steel tube, after treatment by heating
and quenching from the bore.



Diameters, in two planes, measured along the bore, at intervals of 3/4", numbered from 1 to 27 each way from the middle of the tube.

The Norris Peters Co., Photo-Litho., Washington, D.C.

H Doc 508 57 1

INTERNAL STRAINS IN A STEEL TUBE AFTER TREATMENT.

OBJECTS OF THE TEST.

To ascertain if the internal strains in a thin, transverse slice taken from a hollow gun forging represent the strains in the intact forging; that is, whether the state of the metal in a detached slice may be accepted as an index of the state of the metal in the forging, having reference to tangential internal strains introduced by the method of heating and quenching a tube at the bore. Also, to obtain data upon the magnitude of the concomitant longitudinal strains, and, furthermore, the effect of exposure to higher temperatures in the elimination of strains introduced by heat treatment.

CONCLUSIONS.

I. The detached slices represent the state of the metal in the intact tube with respect to the direction of the internal strains, and approximately with respect to their magnitude.

II. The metal at the bore is under a higher degree of initial compression than indicated by the detached slices. In the present tests the difference is 3,000 pounds per square inch, the mean compressive stresses in slices which display 25,625 pounds per square inch compressive stress at the bore.

III. Longitudinal strains of compression at the bore are present, which may be taken approximately at three-fourths of the tangential strains. In the present instance the mean results show the longitudinal strains are .78 of the tangential strains.

IV. The ends of the tube are bell shaped, in consequence of the longitudinal compressive strains at the bore.

V. The state of the metal at the bore at the ends of the tube, by reason of the bell-shaped form, is under greatly diminished tangential strains.

VI. Annealing eliminates internal strains. The strains which are introduced into the forging by reason of sudden quenching from a moderately high temperature are removed upon exposure to a moderately high temperature when slowly cooled.

VII. The elimination of internal strains was practically completed when exposed to a temperature of 1,100° F. About one-half the primitive strains remained after exposure to 700° or 800° F.

VIII. This relief of internal strains is accomplished without material relative movements of the parts of the forging. That is, the opposing parts which were under different kinds of strains, tensile and compressive, maintain their dimensions and relative positions after annealing unchanged.

REMARKS.

This tube was prepared by the Bethlehem Iron Company by heating and quenching from the bore, following the method adopted in treating the tubes of the 5-inch R. F. guns.

Diameters were established along the bore in two planes, and at intervals of ¾″ each. The tube was measured on these diameters, then cut apart at the middle of its length and remeasured. For identification the halves were marked A–B and A_1–B_1 and the measured diameters successively numbered from 1 to 27, beginning at the inner ends of the two sections. After cutting apart, a slice ½″ long was taken from the inner ends of each piece, which were designated as A–B 1 and A_1–B_1 1. Using section A–B, additional slices were detached, remeasuring a number of the diameters in the remaining part of the section after groups of four slices were detached, and thus proceeding until seventeen slices in all were removed. The detached slices were remeasured at the bore, surface diameters established on the ends and rings detached, one at the bore and one from the outside. Rings from four of the slices were taken out with the metal in the state it came from the forging. Ten slices were annealed at temperatures ranging from 207° F. to 1,100° F. prior to detaching the individual rings, and three slices are reserved for experiments on local heating at the bore. The remainder of section A–B, comprising bore diameters 18 to 27, was used for determining the longitudinal strains released upon turning off the exterior metal, leaving a thin cylinder of metal next the bore. Longitudinal gauged lengths were established in the bore on four lines.

From observations made upon cutting off slices from the ends of the tube it appears that the metal tends to expand and assume a bell-shaped form at the ends of the section, and when slices are successively detached the new ends thus formed each in turn display this action. At a distance of ¼″ from the end the mean expansion in diameter was ″.00224, which diminished to ″.00092 at a distance of 1″ from the end. On more remote diameters the effect was lost or of insufficient magnitude to present decisive indications. The stresses corresponding to the strains above stated are 13,200 and 5,400 pounds per square inch, respectively, which were strains of compression.

A comparison of the bore diameters of the detached slices with the same diameters when in the tube, at a distance from its ends, beyond the bell-shaped zone, makes it appear that the detached slices are slightly larger than when forming an integral part of the tube. The conditions under which the measurements were taken precluded the accuracy sometimes attained in experiments of this class. From all of the data developed it appears, however, that the slices were at least ″.0005 larger at the bore than when forming a part of the tube, which on this diameter corresponds to a stress of 3,000 pounds per square inch. That is, the metal at the surface of the tube is apparently under a compressive stress 3,000 pounds per square inch higher than when in the detached slice. The detached rings showed the release of compressive stresses at the bore, from the state of the metal in the slice, amounting to 25,625 pounds per square inch, the means of four rings, while rings from the exterior of the same slices gave the mean tensile stress 6,725 pounds per square inch, the mean strains released being in rings 1, ″.00445 and in rings 2, ″.00182. The rings from the annealed slices gave the following results:

Slice.	Annealing temperature.	Strains released.		Stresses per square inch.	
		Rings 1.	Rings 2.	Rings 1, compression.	Rings 2, tension.
	° *F.*	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
A-B 2	207	.00465	.0011	26,700	4,170
A-B 3	302	.00345	.00185	19,900	7,000
A-B 4	403	.00295	.0007	17,000	2,800
A-B 6	505	.0038	.0005	21,900	1,900
A-B 7	600	.00355	.0013	20,400	4,900
A-B 8	700	.00215	.0004	12,400	1,500
A-B 10	805	.0025	.00045	14,400	1,600
A-B 11	905	.00145	.00025	8,800	900
A-B 12	1,000	.0008	.00015	4,600	600
A-B 14	1,100	.0003	[a].00045	1,700	[a]1,700

[a] Compressive strain and stress.

The reduction in the magnitude of the internal strains upon exposure to different annealing temperatures is illustrated in the above table. The partial or complete relief from such strains, it is seen, may be accomplished by temperatures below the plastic state of the metal. While earlier tests have shown that different parts of a forging may move about relatively, within limits, at high softening heats, and when subsequently cooled left practically free from internal strains, such measureable relative movements are not apparently essential to the relief of internal strains. In the present series, measurements of the intact slices before and after annealing showed very small changes in dimensions, generally less than ".0001, and since the residual strains in the annealed slices were largely reduced, as may be seen upon comparison of the strains developed by the rings not annealed with those which were, it is inferred that the relief of internal strains may be accomplished with slight or perhaps no measureable change in the general dimensions of the forging.

MEASUREMENT OF DIAMETERS ALONG THE BORE.

TUBE INTACT.

Number.	Micrometer readings, diameters.					
	A.	B.	Mean.	A₁.	B₁.	Mean.
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1	.0127	.0077	.0102	.0122	.0106	.0114
2	.0124	.0098	.0111	.0118	.0127	.01225
3	.0121	.0092	.01065	.0128	.0127	.01275
4	.0107	.0077	.0092	.0132	.0122	.0127
5	.0105	.0083	.0094	.0127	.0121	.0124
6	.0112	.0092	.0102	.0122	.0113	.01175
7	.0106	.0103	.01045	.0112	.0115	.01135
8	.0084	.0092	.0088	.0108	.0113	.01105
9	.0100	.0095	.00975	.0117	.0104	.01105
10	.0088	.0091	.00895	.0112	.0107	.01095
11	.0092	.0071	.00815	.0100	.0103	.01015
12	.0086	.0090	.0088	.0093	.0105	.0099
13	.0085	.0097	.0091	.0173	.0163	.0168
14	.0112	.0098	.0105	.0186	.0165	.01755
15	.0102	.0092	.0097	.0134	.0173	.01535
16	.0091	.0098	.00945	.0168	.0178	.0173
17	.0090	.0095	.00925	.0172	.0173	.01725
18	.0096	.0112	.0104	.0160	.0167	.01635
19	.0122	.0103	.01125	.0168	.0177	.01725
20	.0102	.0106	.0104	.0175	.0172	.01735
21	.0101	.0119	.0110	.0177	.0185	.0181
22	.0107	.0104	.01055	.0188	.0203	.01955
23	.0100	.0117	.01085	.0181	.0188	.01845
24	.0111	.0102	.01065	.0157	.0160	.01585
25	.0162	.0149	.01555	.0193	.0166	.01795
26	.0187	.0177	.0182	.0195	.0204	.01995
27	.0222	.0217	.02195	.0163	.0193	.0178

TUBE CUT APART AT MIDDLE OF LENGTH.

The halves now measured as follows:

Number.	Micrometer readings, diameters.					
	A.	B.	Mean.	A₁.	B₁.	Mean.
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1	.0143	.0102	.01225	.0142	.0132	.0137
2	.0126	.0107	.01165	.0122	.0136	.0129
3	.0117	.0092	.01045	.0132	.0128	.0130
4	.0102	.0076	.0089	.0127	.0121	.0124
5	.0100	.0082	.0091	.0124	.0117	.01205
6	.0108	.0088	.0098	.0120	.0112	.0116
7	.0104	.0102	.0103	.0112	.0114	.0113
8	.0084	.0091	.00875	.0109	.0113	.0111
9	.0102	.0095	.00985	.0118	.0107	.01125
10	.0092	.0091	.00915	.0114	.0109	.01115
11	.0093	.0073	.0083	.0104	.0106	.0105
12	.0087	.0092	.00895	.0097	.0108	.01025
13	.0088	.0097	.00925	.0177	.0167	.0172
14	.0113	.0099	.0106	.0188	.0167	.01775
15	.0102	.0093	.00975	.0137	.0177	.0157
16	.0094	.0100	.0097	.0170	.0182	.0176
17	.0092	.0095	.00935	.0175	.0177	.0176
18	.0098	.0113	.01055	.0162	.0167	.01645
19	.0123	.0103	.0113	.0172	.0182	.0177
20	.0104	.0106	.0105	.0178	.0172	.0175
21	.0102	.0120	.0111	.0182	.0188	.0185
22	.0108	.0106	.0107	.0192	.0206	.0199
23	.0103	.0118	.01105	.0184	.0192	.0188
24	.0114	.0103	.01085	.0161	.0163	.0162
25	.0164	.0150	.0157	.0197	.0163	.0180
26	.0191	.0177	.0184	.0198	.0209	.02035
27	.0224	.0220	.0222	.0167	.0197	.0182

Slices 1 A–B, 1 A_1–B_1, cut off inner ends of the halves of the tube.

DETACHED SLICES.

Number.	Micrometer readings, diameters.					
	A.	B.	Mean.	A_1.	B_1.	Mean.
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1	.0126	.0078	.0102	.0126	.0107	.01165

MEASUREMENTS ON REMAINING PART OF TUBE.

2	.0145	.0124	.01345	.0188	.0152	.0145
3	.0124	.0100	.0112	.0137	.0137	.0137
4	.0106	.0079	.00925	.0130	.0125	.01275
5	.0103	.0084	.00935	.0124	.0118	.0121
6	.0110	.0091	.01005	.0120	.0114	.0117
7	.0105	.0105	.0105	.0112	.0116	.0114
8	.0086	.0092	.0089	.0110	.0115	.01125
23	.0104	.0118	.0111	.0184	.0192	.0188
24	.0114	.0105	.01095	.0161	.0162	.01615
25	.0164	.0151	.01575	.0197	.0166	.01815
26	.0191	.0164	.01775	.0200	.0210	.0205
27	.0225	.0221	.0223	.0168	.0197	.01825

Slices 2–5 A–B cut off inner end of the section A—B.

DETACHED SLICES.

Number.	Micrometer readings, diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
2	.0128	.0102	.0115
3	.0122	.0098	.0110
4	.0111	.0082	.00965
5	.0109	.0091	.0100

MEASUREMENTS ON REMAINING PART OF TUBE.

6	.0131	.0112	.01215
7	.0111	.0111	.0111
8	.0086	.0092	.0089
9	.0102	.0095	.00985
10	.0090	.0091	.00905
11	.0094	.0075	.00845
12	.0089	.0092	.00905

Slices 6–9 A–B cut off inner end of the section A—B.

DETACHED SLICES.

Number.	Micrometer readings, diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
6	.0115	.0097	.0106
7	.0108	.0110	.0109
8	.0092	.0095	.00935
9	.0105	.0100	.01025

MEASUREMENTS ON THE REMAINING PART OF TUBE.

Number.	A.	B.	Mean.
10	.0112	.0111	.01115
11	.0101	.0081	.0091
12	.0089	.0092	.00905
13	.0088	.0096	.0092
14	.0112	.0098	.0105
15	.0102	.0093	.00975
16	.0096	.0101	.00985

Slices 10–13 A–B cut off inner end of section A—B.

DETACHED SLICES.

Number.	Micrometer readings, diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch*
10	.0096	.0095	.00955
11	.0098	.0081	.00895
12	.0094	.0095	.00945
13	.0094	.0104	.0099

MEASUREMENTS ON THE REMAINING PART OF TUBE.

Number.	A.	B.	Mean.
14	.0138	.0122	.0130
15	.0113	.0100	.01065
16	.0098	.0104	.0101
17	.0093	.0095	.0094
18	.0098	.0113	.01055
19	.0125	.0105	.0115
20	.0106	.0108	.0107
21	.0105	.0124	.01145
22	.0112	.0106	.0109
23	.0106	.0121	.01135
24	.0118	.0106	.0112
25	.0168	.0150	.0159
26	.0195	.0164	.01795
27	.0224	.0221	.02235

Slices 14–17 A–B cut off inner end of section A—B.

DETACHED SLICES.

Number.	Micrometer readings, diameters.		
	A.	B.	Mean.
	Inch.	*Inch.*	*Inch.*
14	.0120	.0106	.0113
15	.0108	.0100	.0104
16	.0099	.0104	.01015
17	.0096	.0099	.00975

MEASUREMENTS ON THE REMAINING PART OF TUBE.

Number.	A.	B.	Mean.
18	.0120	.0136	.0128
19	.0134	.0115	.01245
20	.0106	.0109	.01075
21	.0104	.0123	.01135
22	.0111	.0105	.0108
23	.0105	.0120	.01125
24	.0117	.0105	.0111
25	.0167	.0148	.01575
26	.0194	.0163	.01785
27	.0224	.0220	.0222

Internal Strains Determined in Rings from the Detached Slices.

Slice A–B 1.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2346	5.2403	5.23745				
2	7.9889	7.9767	7.9828				

RINGS DETACHED.

Rings.	A.	B.	Mean.	Strains, Tension.	Strains, Compression.	Stresses, Tension.	Stresses, Compression.
1 detached	5.2401	5.2434	5.24175		.0043		24,600
2 detached	7.9875	7.9751	7.9813	.0015		5,700	

SLICE A-B 2.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2241	5.2252	5.22465				
2	7.9194	7.9138	7.9166				

SLICE ANNEALED (INTACT) IN OIL AT 207° F.

1	5.2241	5.2251	5.2246				
2	7.9194	7.9138	7.9166				

RINGS DETACHED.

1 detached	5.2286	5.2299	5.22925		.00465		26,700
2 detached	7.9209	7.9101	7.9155	.0011		4,170	

Bore, A ″.0180, ring detached.
Bore, B ″.0145, ring detached.

SLICE A-B 3.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2104	5.2102	5.2103				
2	7.9309	7.9238	7.92735				

SLICE ANNEALED (INTACT) IN OIL AT 302° F.

1	5.2104	5.2102	5.2103				
2	7.9309	7.9238	7.92735				

RINGS DETACHED.

1 detached	5.2155	5.2120	5.21375		.00345		19,900
2 detached	7.9283	7.9227	7.9255	.00185		7,000	

Bore, A ″.0185, ring detached.
Bore, B ″.0127, ring detached.

SLICE A–B 4.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2115	5.2084	5.20995	....	....	....	....
2	7.9339	7.9245	7.9292	....	....	....	....

SLICE ANNEALED (INTACT) IN OIL AT 403° F.

1	5.2115	5.2083	5.2099	....	....	....	....
2	7.9338	7.9244	7.9291	....	....	....	....

RINGS DETACHED.

1 detached	5.2157	5.2100	5.21285	....	.00295	....	17,000
2 detached	7.9330	7.9238	7.9284	.0007	....	2,800	....

Bore, A ″.0161, ring detached.
Bore, B ″.0111, ring detached.

SLICE A–B 5.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2095	5.2150	5.21225	....	....	....	....
2	7.9295	7.9261	7.9278	....	....	....	....

RINGS DETACHED.

1 detached	5.2150	5.2183	5.21665	....	.0044	....	25,300
2 detached	7.9282	7.9236	7.9259	.0019	....	7,200	....

Bore, A ″.0165, ring detached.
Bore, B ″.0125, ring detached.

SLICE A–B 6.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2096	5.2056	5.2076	....	....	....	....
2	7.9278	7.9332	7.9305	....	....	....	....
SLICE ANNEALED (INTACT) IN OIL AT 505° F.							
1	5.2096	5.2055	5.20755	....	....	....	....
2	7.9272	7.9331	7.93015	....	....	....	....
RINGS DETACHED.							
1 detached	5.2140	5.2087	5.21135	....	.0038	....	21,900
2 detached	7.9243	7.9350	7.92965	.0005	....	1,900	....

Bore, A ″.0159, ring detached.
Bore, B ″.0135, ring detached.

SLICE A–B 7.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2061	5.2059	5.2060	....	....	....	....
2	7.9364	7.9317	7.93405	....	....	....	....
SLICE ANNEALED (INTACT) IN OIL AT 600° F.							
1	5.2061	5.2058	5.20595	....	....	....	....
2	7.9363	7.9317	7.9340	....	....	....	....
RINGS DETACHED.							
1 detached	5.2090	5.2100	5.2095	....	.00355	....	20.400
2 detached	7.9370	7.9284	7.9327	.0013	....	4,900	....

Bore, A ″.0140, ring detached.
Bore, B ″.0154, ring detached.

SLICE A-B 8.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2176	5.2147	5.21615				
2	7.9363	7.9338	7.93505				
SLICE ANNEALED (INTACT) IN OIL AT 700° F.							
1	5.2175	5.2147	5.2161				
2	7.9363	7.9336	7.93495				
RINGS DETACHED.							
1 detached	5.2197	5.2168	5.21825		.00215		12,400
2 detached	7.9375	7.9316	7.93455	.0004		1,500	

Bore, A ″.0113, ring detached.
Bore, B ″.0114, ring detached.

SLICE A-B 9.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2175	5.2166	5.21705				
2	7.9346	7.9358	7.9352				
RINGS DETACHED.							
1 detached	5.2232	5.2202	5.2217		.0046		26,700
2 detached	7.9326	7.9336	7.9331	.0021		7,900	

Bore, A ″.0156, ring detached.
Bore, B ″.0144, ring detached.

SLICE A–B 10.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2140	5.2141	5.21405	....	....	....	....
2	7.9361	7.9323	7.9342	....	....	....	....
SLICE ANNEALED (INTACT) IN OIL AT 805° F.							
1	5.2141	5.2140	5.21405	....	....	....	....
2	7.9359	7.9322	7.93405	....	....	....	....
RINGS DETACHED.							
1 detached	5.2163	5.2168	5.21655	....	.0025	....	14,400
2 detached	7.9371	7.9307	7.9336	.00045	....	1,600	....

Bore, A ″.0119, ring detached.
Bore, B ″.0116, ring detached.

SLICE A–B 11.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2181	5.2200	5.21905	....	....	....	....
2	7.9496	7.9466	7.9481	....	....	....	....
SLICE ANNEALED (INTACT) IN OIL AT 905° F.							
1	5.2178	5.2201	5.21895	....	....	....	....
2	7.9492	7.9468	7.9480	....	....	....	....
RINGS DETACHED.							
1 detached	5.2194	5.2214	5.2204	....	.00145	....	8,800
2 detached	7.9488	7.9467	7.94775	.00025	....	900	....

Bore, A ″.0094, ring detached.
Bore, B ″.0110, ring detached.

SLICE A–B 12.

Rings.	Diameters.		Mean.	Strains.		Stresses.	
	A.	B.		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2191	5.2175	5.2183				
2	7.9285	7.9401	7.9343				
SLICE ANNEALED (INTACT) IN OIL AT 1,000° F.							
1	5.2188	5.2171	5.21795				
2	7.9280	7.9396	7.9338				
RINGS DETACHED.							
1 detached	5.2196	5.2179	5.21875		.0008		4,600
2 detached	7.9280	7.9393	7.93365	.00015		600	

Bore, A ″.0096, ring detached.
Bore, B ″.0092, ring detached.

SLICE A–B 13.

Rings.	Diameters.			Strains.		Stresses.	
	A.	B.	Mean.	Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2115	5.2170	5.21425				
2	7.9554	7.9445	7.94995				
RINGS DETACHED.							
1 detached	5.2169	5.2206	5.21875		.0045		25,900
2 detached	7.9535	7.9428	7.94815	.0018		6,100	

Bore, A ″.0144, ring detached.
Bore, B ″.0145, ring detached.

SLICE A–B 14.

Rings.	Diameters.			Strains.		Stresses.	
	A.	B.	Mean.	Tension.	Compression.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	5.2060	5.2114	5.2087	....	....	....	....
2	7.9554	7.9440	7.9497	....	....	....	....

SLICE ANNEALED (INTACT) IN OIL AT 1,100° F.

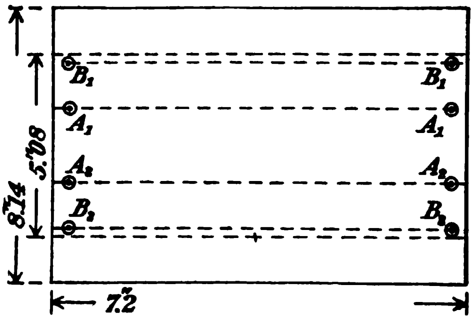
(Holes defining extremities of diameters reamed after annealing.)

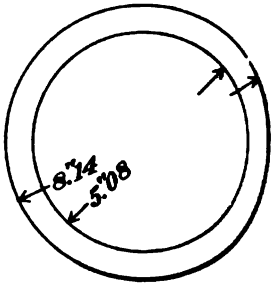
1	5.2059	5.2105	5.2082	....	....	....	....
2	7.9549	7.9428	7.94885	....	....	....	....

RINGS DETACHED.

1 detached	5.2062	5.2108	5.2085	....	.0003	....	1,700
2 detached	7.9562	7.9424	7.9493	....	.00045	....	1,700

Bore, A ″.0116, ring detached.
Bore, B ″.0096, ring detached.





Section A–B, diameters 18 to 27, was turned down from 1″.535, the original thickness of the tube, to ″.165 thickness of walls.

Longitudinal and diametrical measurements taken before and after turning down gave the following results:

LONGITUDINAL STRAINS RELEASED AND THEIR CORRESPONDING STRESSES.

Gauged lines.	Measurements taken.		Strains released.	Stresses corresponding, compression per square inch.
	Walls of full thickness.	Walls ″.165 thick.		
	Inches.	*Inches.*	*Inch.*	*Pounds.*
A_1	6.7094	6.7146	.0052	23,300
B_1	6.7040	6.7085	.0045	20,100
A_2	6.6836	6.6880	.0044	19,700
B_2	6.6964	6.7015	.0049	22,000
Mean compressive stress	....	....	....	21,300

DIAMETRICAL STRAINS RELEASED AND THEIR CORRESPONDING STRESSES.

Micrometer readjusted since taking earlier measurements.

No. of diameter.	Micrometer readings, diameters.						Strains released.	Stresses corre-sponding, compres-sion.
	Walls of full thickness.			Walls ".165 thick.				
	A.	B.	Mean.	A.	B.	Mean.		
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Pounds.*
18	.0446	.0460	.0453	.0475	.0486	.04805	.00275	16,200
19	.0460	.0439	.04495	.0504	.0480	.0492	.00425	25,100
20	.0432	.0433	.04325	.0483	.0482	.04825	.0050	29,500
21	.0428	.0448	.0438	.0481	.0500	.04905	.00525	31,000
22	.0436	.0433	.04345	.0490	.0486	.0488	.00535	31,600
23	.0430	.0447	.04385	.0483	.0501	.0492	.00535	31,600
24	.0441	.0430	.04355	.0493	.0486	.04895	.0054	31,800
25	.0490	.0469	.04795	.0541	.0522	.05315	.0052	30,600
26	.0511	.0502	.05065	.0560	.0551	.05555	.0049	29,000
27	.0551	.0550	.05505	.0576	.0580	.0578	.00275	16,200

CAST IRON AND PIG IRONS.

TENSION TESTS AND CHEMICAL ANALYSES.

Cast Iron from Watertown Arsenal Foundry.

No. of test.	Mark.	Description.	Chemical composition.								Diameter.	Tensile strength per square inch.	Fracture.	Specific gravity.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
											Inches.	*Pounds.*		
6438	162	3″ shell									1.129	25,200	Fine granular, gray	7.210
6439	165	do									1.129	26,100	do	7.229
6447	167	do									1.129	25,840	do	7.062
6454	170	do									.505	29,900	do	
6459	175	do									1.129	23,500	Granular, gray	7.157
6460	176	do									1.129	26,790	Fine granular, gray	7.143
6463	179	do									1.129	25,980	Fine and medium coarse granular, gray.	7.172
6488	181	do									.505	24,900	Granular, gray	7.079
6486	183	do									1.129	20,300	do	7.061
6489	184	do									.505	25,450	do	7.144
6487	186	do									1.129	28,040	Granular, light gray	7.294
6494	189	do									1.129	27,100	do	7.203
6499	191	do									1.129	23,180	do	7.185
6502	192	do									.505	25,000	do	
6506	194	do									.505	26,400	Granular, gray	6.976
6512	195	do									.505	26,900	do	7.125
6513	197	do									.505	29,450	do	7.278
6514	199	do									.505	28,000	do	7.296
6515	200	do									.505	28,900	do	7.076
6521	201	do									.505	32,000	Fine granular, light gray	7.287
6525	202	do									.505	27,500	do	7.234
6527	205	do									.505	29,750	do	7.236
6529	206	do									.505	30,250	do	7.183
6533	207	do									.505	29,000	do	6.996
6535	208	do									.505	26,500	do	7.213
6559	217	do									.505	25,500	Granular, light gray	7.021
6562	219	do									.505	26,000	do	7.178
6563	220	do									.505	28,500	Fine granular, light gray	6.802
6568	223	do									.505	29,550	do	7.222
6571	225	do									.505	29,550	do	7.299
6575	229	do									.505	29,600	do	6.989
6576	231	do									.505	31,000	do	7.126
6578	233	do									.505	29,000	do	6.941
6579	234	do									.505	28,900	do	7.065
6582	236	do									.505	28,500	do	6.969

Cast Iron from Watertown Arsenal Foundry—Continued.

No. of test.	Mark.	Description.	Chemical composition.								Diameter.	Tensile strength per square inch.	Fracture.	Specific gravity.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total	Graphitic.	Combined.									
											Inches.	*Pounds.*		
6585	237	3″ shell									.505	27,500	Fine granular, light gray	7.018
6586	238	do									.505	30,350	do	7.318
6589	241	do									.505	29,400	do	7.208
6592	242	do									.564	29,680	do	7.133
6593	243	do									.564	32,800	do	7.016
6594	246	do									.564	33,160	do	7.353
6602	252	do									.505	30,500	do	7.599
6603	253	do									.505	27,600	do	7.167
6607	256	do									.505	24,100	do	7.122
6608	257	do									.505	29,250	do	7.268
6609	258	do									.505	23,900	do	7.142
6610	259	do									.505	28,350	Granular, light gray	6.986
6613	261	do									.505	25,000	Fine granular, light gray	6.980
6614	262	do									.505	21,900	do	7.045
6617	264	do									.505	21,500	do	7.179
6618	265	do									.505	23,050	do	6.989
6620	267	do									.505	22,650	do	7.285
6622	269	do									.505	26,050	do	7.096
6623	270	do									.505	23,450	Granular, light gray	7.123
6624	271	do									.505	24,450	Granular, gray	7.203
6625	272	do									.505	22,200	Fine granular, gray	7.126
6627	273	do									.505	22,600	do	7.122
6628	274	do									.505	29,250	Fine granular, light gray	7.217
6629	276	do									.505	30,600	do	7.279
6630	279	do									.505	21,000	Granular, gray	7.045
6631	280	do									.505	29,200	Fine granular, light gray	7.249
6635	282	do									.505	29,450	do	7.325
6639	285	do									.505	30,950	do	6.776
6643	288	do									.505	28,550	do	7.002
6645	290	do									.505	27,000	do	6.891
6647	292	do									.505	28,550	do	7.236
6648	293	do									.505	24,150	Fine granular, gray	7.066
6650	294	do									1.129	21,800	do	7.231
6652	296	do									.505	26,100	do	7.133
6653	297	do									.505	27,800	Fine granular, light gray	7.035
6657	299	do									.505	26,600	do	6.942

6659	301	3″ shell									.505	29,550	Fine granular, light gray	7.235
6661	302	....do									.505	21,000	Granular, gray	7.081
6662	305	....do									.505	25,500	Fine granular, gray	7.115
6490	25	3″.2 shell									1.129	20,350	Granular, dark gray	
6491	26	....do									1.129	19,900	....do	
6425	154	8″, 10″, and 12″ shot and shell									1.129	31,300	Fine granular, light gray, mottled.	
6426	156	....do									1.129	27,780	Granular, gray	7.186
6427	157	....do									1.129	29,400	....do	7.146
6431	159	....do									1.129	29,990	Fine granular, light gray, mottled.	7.137
6434	160	....do									1.129	29,200	Fine granular, gray, spongy at circumference.	7,197
6436	163	....do									1.129	26,720	Fine granular, light gray, mottled.	7.240
6446	168	....do									1.129	28,020	Fine granular, light gray	7.218
6453	169	....do									1.129	27,900	Fine granular, gray	7.073
6456	173	8″ shot and 12″ shell									1.129	29,300	....do	7.109
6458	174	....do									1.129	27,470	Fine granular, gray, mottled	7.181
6461	177	....do									1.129	30,400	Granular, gray	7.142
6621	268	10″ shot									1.129	28,100	....do	7.229
6626	275	....do									1.129	26,500	Fine granular, light gray	7.212
6632	277	....do									1.129	26,100	....do	7.275
6633	278	....do									1.129	28,750	....do	7.210
6638	281	....do									1.129	32,200	....do	7.120
6636	283	....do									1.129	29,950	....do	7.235
6642	287	....do									1.129	27,100	....do	7.275
6644	289	....do									1.129	28,600	....do	7.249
6646	291	....do									1.129	29,800	....do	7.286
6651	295	....do									.505	32,000	....do	7.394
6656	298	....do									1.129	21,700	....do	7.258
6654	300	....do									1.129	30,100	Granular, light gray	7.193
6464	180	12″ shell									1.129	27,990	Granular, gray, mottled	7.199
6482	185	....do									1.129	26,980	....do	7.211
6496	187	....do									1.129	24,550	Granular, light gray, granitic	7.200
6498	190	....do									1.129	25,450	Granular, gray	7.062
6545	210	....do									1.129	25,500	Granular, light gray	7.187
6547	211	....do									1.129	25,200	....do	7.173
6546	213	....do									1.129	23,300	....do	7.226
6549	213	....do									1.129	25,100	Granular, light gray, mottled	
6550	213	....do									1.129	25,200	....do	
6551	213	....do									1.129	24,800	....do	
6552	213	....do									.505	26,000	....do	
6553	213	....do									1.129	25,100	....do	
6554	213	....do									1.129	24,700	....do	
6555	213	....do									1.129	25,500	....do	
6556	213	....do									.505	27,800	....do	
6560	215	....do									1.129	25,000	Granular, gray	7.185
6567	221	....do									1.129	26,120	Fine granular, light gray	7.318
6570	226	12″ shell, 3″ stem									.564	28,080	....do	7.053
6572	228	12″ shell									1.129	21,500	....do	7.276
6591	244	....do									1.129	25,550	Fine granular, gray	7.246

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY—Continued.

No. of test.	Mark.	Description.	Chemical composition.								Diameter.	Tensile strength per square inch.	Fracture.	Specific gravity.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
											Inches.	*Pounds.*		
6595	247	12" shell	......	......	......	......	......	......	......	......	1.129	26,310	Granular, gray	7.194
6598	248	....do	......	......	......	......	......	......	......	......	1.129	23,000	....do	7.118
6599	249	....do	......	......	......	......	......	......	......	......	1.129	24,400	....do	7.118
6600	250	....do	......	......	......	......	......	......	......	......	1.129	26,300	Fine granular, light gray	7.130
6601	251	....do	......	......	......	......	......	......	......	......	1.129	27,290	....do	7.282
6602	254	....do	......	......	......	......	......	......	......	......	1.129	36,510	....do	7.209
6612	260	....do	......	......	......	......	......	......	......	......	.564	30,960	Fine granular, gray	7.132
6616	263	....do	......	......	......	......	......	......	......	......	1.129	32,000	Fine granular, light gray	7.143
6663	306	....do	......	......	......	......	......	......	......	......	1.129	28,230	Granular, gray	7.128
6566	222	12" dummy projectiles	......	......	......	......	......	......	......	......	1.129	26,300	Granular, light gray	7.117
6602	254	10" mortar, top carriage	......	......	......	......	......	......	......	......	1.129	36,510	Fine granular, light gray	7.209
6561	218	10" mortar carriage, racer	......	......	......	......	......	......	......	......	1.129	27,900	Granular, light gray	7.208
6480	182	12" disappearing carriage, base ring.	......	......	......	......	......	......	......	......	1.129	29,400	....do	7.194
6612	260	....do	......	......	......	......	......	......	......	......	.564	30,960	Fine granular, gray	7.132
6616	263	....do	......	......	......	......	......	......	......	......	1.129	32,000	Fine granular, light gray	7.143
6621	268	....do	......	......	......	......	......	......	......	......	1.129	28,100	Granular, gray	7.229
6428	158	12" disappearing carriage, cheek	......	......	......	......	......	......	......	......	1.129	33,520	....do	....
6430	171	....do	......	......	......	......	......	......	......	......	1.129	31,900	Fine granular, light gray	....
6455	172	12" disappearing carriage, roller path.	......	......	......	......	......	......	......	......	1.129	30,500	Fine granular, gray	7.125
6493	188	12" disappearing carriage	......	......	......	......	......	......	......	......	1.129	29,480	Ganular, light gray	7.214
6437	164	12" mortar, top carriage	......	......	......	......	......	......	......	......	1.129	33,980	Fine granular, light gray	7.219
6574	230	....do	......	......	......	......	......	......	......	......	1.129	29,700	....do	7.184
6587	240	....do	......	......	......	......	......	......	......	......	1.129	29,800	....do	7.186
6596	240	....do	......	......	......	......	......	......	......	......	1.129	28,550	Granular, gray	7.124
6597	240	....do	......	......	......	......	......	......	......	......	1.129	29,500	....do	7.150
6612	260	....do	......	......	......	......	......	......	......	......	.564	30,960	Fine granular, gray	7.132
6616	263	....do	......	......	......	......	......	......	......	......	1.129	32,000	Fine granular, light gray	7.143
6621	268	....do	......	......	......	......	......	......	......	......	1.129	28,100	Granular, gray	7.229
6651	300	....do	......	......	......	......	......	......	......	......	1.129	30,100	Granular, light gray	7.193
6558	216	12" mortar carriage, distance ring	......	......	......	......	......	......	......	......	.564	25,400	....do	7.211
6577	232	....do	......	......	......	......	......	......	......	......	.505	19,800	Fine granular, gray, spongy, with blowholes.	6.813
6424	155	12" mortar carriage, base ring	......	......	......	......	......	......	......	......	1.129	31,020	Fine granular, light gray, mottled.	7.252

6437	161	12" mortar carriage, base ring									1.129	33,980	Fine granular, gray	7.219
6480	182	....do									1.129	29,400	Granular, light gray	7.194
6510	196	....do									1.129	25,200	Granular, gray	7.210
6522	203	....do									1.129	28,000	Fine granular, gray	7.129
6534	209	....do									1.129	37,980	Fine granular, light gray	7.258
6561	218	....do									1.129	27,900	Granular, light gray	7.208
6574	230	....do									1.129	29,700	Fine granular, light gray	7.184
6587	240	....do									1.129	29,800	....do	7.186
6605	254	....do									1.129	36,510	....do	7.209
6654	300	....do									1.129	30,100	Granular, light gray	7.193
6663	306	....do									1.129	28,230	Granular, gray	7.128
6435	161	12" mortar carriage, racer									1.129	29,840	Fine granular, light gray	
6462	178	....do		2.394		0.320	1.600	0.072	0.521		1.129	34,600	Fine granular, gray	7.198
6501	193	....do									1.129	30,700	Granular, light gray	7.084
6516	198	....do									1.129	31,900	Fine granular, light gray	7.218
6532	204	....do									1.129	28,800	....do	7.068
6544	212	....do									1.129	30,400	Granular, gray	7.169
6557	214	....do									1.129	31,020	Granular, light gray	7.177
6565		12" mortar carriage (from part burnt on), racer.									1.129	17,000	Granular, dark gray	7.017
6569	224	12" mortar carriage, racer									1.129	29,300	Granular, light gray	7.259
6573	227	....do									1.129	31,500	Fine granular, light gray	7.211
6581	235	....do									1.129	30,500	....do	7.138
6584	239	....do									1.129	32,050	....do	7.177
6590	245	....do									1.129	33,450	Fine granular, gray	7.196
6606	255	....do									1.129	29,500	Granular, light gray	7.160
6619	266	....do									1.129	31,100	Granular, gray	7.183
6649	286	....do									.505	29,600	Fine granular, gray	7.051
6523	W.	Test of weld (burnt together)									.798	28,160	Fine granular, dark gray	
6524	M.	Test of plain bar, the above									.798	17,780	Granular gray, spongy at circumference.	
6457	A.O.Co.	Projectile for Lyle life-saving gun									1.129	19,100	Fine granular, light gray, dull.	
6528	L 2	4-pounder									.505	21,450	Fine granular, gray	
6660	304	Azimuth circle									.505	15,850	Granular, gray, two blow holes.	6.896

CAST IRON FURNISHED BY PRIVATE PARTIES.

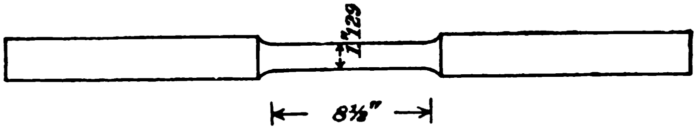
6410	Heat 1	Common shell, 15-pounder									.505	26,050	Fine granular gray	
6411	Heat 2	....do									.505	28,050	....do	
6412	Heat 3	....do									.505	29,950	....do	
6413	Heat 4	....do									.505	27,600	....do	
6414	Heat 5	....do									.505	27,300	....do	
6466	Heat 6	....do									.505	25,400	....do	
6467	Heat 7	....do									.505	25,450	....do	
6468	Heat 8	....do									.505	25,050	....do	
6469	Heat 9	....do									.505	29,900	....do	
6470	Heat 10	....do									.505	24,500	....do	
6471	Heat 11	....do									.505	26,450	....do	

CAST IRON FURNISHED BY PRIVATE PARTIES—Continued.

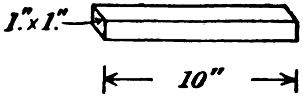
No. of test.	Mark.	Description.	Chemical composition.								Diameter.	Tensile strength per square inch.	Fracture,	Specific gravity.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
											Inches.	*Pounds.*		
6472	Heat 12	Common shell, 15-pounder	.....	.....	.....	.....	.....	.....	.....	.....	.505	22,400	Fine granular gray	.....
6473	Heat 13	....do	.....	.....	.....	.....	.....	.....	.....	.....	.505	23,000	....do	.....
6474	Heat 14	....do	.....	.....	.....	.....	.....	.....	.....	.....	.505	22,050	....do	.....
6475	Heat 15	....do	.....	.....	.....	.....	.....	.....	.....	.....	.505	28,900	....do	.....
6476	Heat 16	....do	.....	.....	.....	.....	.....	.....	.....	.....	.505	27,000	....do	.....
477	Heat 17	....do	.....	.....	.....	.....	.....	.....	.....	.....	.505	27,400	....do	.....
6478	Heat 18	....do	.....	.....	.....	.....	.....	.....	.....	.....	.505	29,000	....do	.....
PIG IRONS.														
6451	1	Salisbury pig No. 1	.....	.....	.....	.....	.....	.....	.....	.....	1.129	26,500	Granular, medium, and fine interspersed.	7.187
6452	2	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	23,650	....do	7.148
6507	T. 1 pig	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	27,200	Granular, gray	7.198
6511	T. 2 pig	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	31,600	Fine granular, light gray	.....
6517	3	....do	3.015	2.290	0.725	.....	1.770	0.120	.....	.....	1.129	35,300	....do	.....
6518	3	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	29,700	....do	.....
6519	3	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	35,900	....do	.....
6536	1	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	28,200	....do	7.231
6537	2	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	28,500	....do	7.251
6538	3	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	21,500	Fine and medium coarse gran.	7.147
6539	1	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	35,500	Fine granular, light gray	.....
6540	2	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	31,000	....do	.....
6541	3	....do	.....	.....	.....	.....	.....	.....	.....	.....	1.129	24,100	Fine and medium granular, gray.	.....
6497	.....	No. 1 soft pig	3.136	2.783	0.353	.....	2.500	0.017	.....	.....	1.129	9,310	Coarse and fine granular, interspersed brilliant facets.	6.970
6580	.....	Pig from Watervleit Arsenal	3.021	2.808	0.213	0.650	1.850	0.050	0.630	.....	1.129	12,500	Medium coarse and fine granular, dark gray.	7.012
6583	3	Muirkirk	3.380	3.300	0.080	0.470	1.700	0.065	0.308	.....	1.129	22,300	Fine granular, gray	7.166

ANCHOR BOLTS FOR GUN CARRIAGES.

Tension specimens.



Bending specimens.



No. of test.	Description.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 8 inches.	Contraction of area.	Appearance or fracture.	Elongation of inch sections.	Bending tests.
		Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*			
10284	1½ inch bolt, for Portland, Me.	1.125	1.00	34,800	58,780	31.1	62.6	Silky, cup shaped.	".20, ".24, ".31, ".76*, ".32, ".24, ".23, ".19.	Bent cold 180°, and closed down upon itself without fracture on tension side of bend.
10385	2½ inch bolt, for Portland, Me.	1.129	1.00	26,600	59,900	29.4	40.6	Silky, spotted with lighter-colored metal.	".22, ".23, ".31, ".52*, ".37, ".28, ".25, ".17.	Bent cold 180°, and closed down without fracture.

PISTON RODS.

PROOF STRESS APPLIED TO PISTON RODS FOR GUN CARRIAGES.

Description.	Tensile stress applied.
	Pounds.
6″ disappearing carriage	40,000
12″ disappearing carriage	150,000

RETRACTION CHAINS FOR 12″ CARRIAGES.

No. 10306.

Baltimore chain.
Diameter of wire of links, ″.70.
Proof stresses applied. 15,000 lbs. tension.

FIRST SECTION, 16′ 4″ LONG.

Applied loads.	Elongation.	Remarks.
Pounds.	*Inches.*	
5,000	0.	Initial load.
15,000	1.20	
5,000	.78	

SECOND SECTION, 15′ 2″ LONG.

5,000	0.	Initial load.
15,000	1.42	
5,000	1.00	

No. 10307.

Watertown Arsenal chain.
Diameter of wire of links, ″.70.

FIRST SECTION, 15′ 3″ LONG.

Applied loads.	Elongation.	Remarks.
Pounds.	*Inches.*	
5,000	0.	Initial load.
15,000	12.68	
5,000	12.30	

SECOND SECTION, 15′ 7″ LONG.

5,000	0.	Initial load.
15,000	13.32	
5,000	12.92	

TENSILE TESTS OF CHAINS.

Samples 5 feet long each.

BALTIMORE CHAIN (BRADLEE & CO., MAKERS).

	Tensile strength.
	Pounds.
From one end	23,900
From other end	28,750

WATERTOWN ARSENAL CHAIN.

From one end	26,700
From other end	29,950

Samples 5 feet long each, from near middle of length of chains.

No. 10308.

	Tensile strength.
	Pounds.
Baltimore chain (Bradlee & Co.)	24,380
Do	28,890

No. 10309.

Watertown Arsenal chain	30,480
Do	29,690

No. 10310.

Watertown Arsenal chain.
Made of Swedish iron.
Length of sample, 4½ feet.
Diameter of wire, ″.68; sectional area, 0.36+2=0.72 square inch.

Applied loads.	Elongation.	Remarks.
Pounds.	*Inches.*	
1,000	0.	Initial load.
2,000	.07	
3,000	.15	
4,000	.23	
5,000	.31	
6,000	.40	
7,000	.57	
8,000	1.02	
9,000	1.53	
10,000	2.16	
11,000	2.85	
12,000	3.61	
13,000	4.25	
14,000	4.90	
15,000	5.69	
1,000	5.51	″.18 resilience.
16,000	6.38	
17,000	7.10	
18,000	7.86	
19,000	8.82	
20,000	9.68	
21,000	10.60	
22,000	11.60	
23,000	12.73	
24,000	14.12	
25,000	15.40	
25,500	16.12	
1,000	15.90	″.22 resilience. Chain rested under initial load 30 minutes, and 15 minutes without load.
1,000	15.90	Test resumed.
25,500	16.14	
26,000	16.16	
26,500	16.23	
26,700	16.50	
26,900	17.05	
27,000	17.70	
27,500	19.15	
28,000	20.50	
28,400	22.10	Tensile strength=39,440 pounds per square inch.

RETEST OF CHAIN AFTER AN INTERVAL OF REST OF EIGHTEEN HOURS.

32,100	....	Tensile strength=44,580 pounds per square inch.

SECOND RETEST OF CHAIN AFTER AN INTERVAL OF REST OF EIGHTEEN DAYS.

35,600	....	Tensile strength=49,440 pounds per square inch.

RETRACTION AND BUFFER BRACKET HOOKS.

Steel castings for barbette carriage for 12-inch B. L. rifle, model 1892.

BUFFER BRACKET.

Measurements for distortion of hook taken from point of hook to corner of body of bracket.

Applied loads.	Distortion of hook.	Applied loads.	Distortion of hook.
Pounds.	*Inch.*	*Pounds.*	*Inch.*
1,000	0.	35,000	.07
10,000	0.	40,000	.12
20,000	.01	45,000	.19
25,000	.02	50,000	.30
30,000	.04	1,000	.24

The two 2-inch bolts securing the bracket to a fixing plate in the testing machine were distorted and were with difficulty removed from place.

BUFFER BRACKET.

Applied loads.	Distortion of hook.	Applied loads.	Distortion of hook.
Pounds.	*Inch.*	*Pounds.*	*Inch.*
1,000	0.	35,000	.06
10,000	0.	40,000	.09
20,000	.01	45,000	.15
25,000	.02	50,000	.25
30,000	.03	1,000	.19

RETRACTION HOOK.

1,000	0.	35,000	.03
10,000	0.	40,000	.03
20,000	.01	45,000	.04
25,000	.02	50,000	.05
30,000	.02	1,000	.03

RETRACTION HOOK.

1,000	0.	35,000	.05
10,000	0.	40,000	.07
20,000	.01	45,000	.12
25,000	.02	50,000	.15
30,000	.04	1,000	.10

HELICAL SPRINGS.

HELICAL SPRINGS, DOUBLE COIL, FOR 12-INCH MORTAR CARRIAGES.

Twenty springs from lot of 58 received June 12, 1901.

DESCRIPTION OF ONE SPRING.

Outside coil, left-hand spring:	
Exterior diameter of coil ....inches..	9.10
Diameter of bar ....do...	1.74
Height of spring unloaded ....do...	14.30
Distance between coils..........do...	.96
Weight..........	85 pounds 0 ounces
Inside coil, right-hand spring:	
Exterior diameter of coil ....inches..	5.55
Diameter of bar ....do...	1.24
Height of spring unloaded..........do...	13.35
Distance between coils..........do...	.57
Weight	34 pounds 12 ounces

COMPRESSION TESTS.

Description.	Height.	Load sustained.	Remarks.
	Inches.	*Pounds.*	
First spring	12.25	17,500	
	12.20	18,800	
	9.75	45,700	Closed down.
	11.85	18,000	
	12.25	14,100	
Second spring	12.25	15,700	
	12.03	18,000	
	9.75	46,600	
	9.70	49,300	Closed down.
	9.75	45,700	
	11.68	18,000	
	12.25	12,350	
Third spring..........	12.25	17,300	
	12.18	18,000	
	9.75	45,400	
	9.72	45,700	Closed down.
	9.75	44,450	
	11.82	18,000	
	12.25	13,560	
Fourth spring	12.25	16,700	
	12.14	18,000	
	9.75	45,800	Closed down.
	11.75	18,000	
	12.25	12,740	
Fifth spring	12.25	17,400	
	12.20	18,000	
	9.75	45,700	Closed down.
	11.83	18,000	
	12.25	13,620	
Sixth spring..........	12.25	17,160	
	12.17	18,000	
	9.75	45,800	Closed down.
	11.75	18,000	
	12.25	13,200	
This spring was closed down and so remained for a period of 41 hours, after which the results were as follows:			
	9.78	44,500	
	11.70	18,000	
	12.25	12,360	
	11.78	18,000	
	9.75	45,700	Closed down.
	11.71	18,000	
	12.25	12,240	
Seventh spring	12.25	15,760	
	12.00	18,000	
	9.75	43,400	
	9.65	46,100	Closed down.
	9.75	42,300	
	11.65	18,000	
	12.25	11,800	

COMPRESSION TESTS—Continued.

Description.	Height.	Load sustained.	Remarks.
	Inches.	*Pounds.*	
Eighth spring	12.25	17,700	
	12.21	18,000	
	9.75	45,600	
	9.63	47,200	Closed down.
	9.75	44,080	
	11.80	18,000	
	12.25	13,320	
Ninth spring	12.25	15,780	
	12.04	18,000	
	9.75	44,800	
	9.70	45,400	Closed down.
	9.75	43,800	
	11.70	18,000	
	12.25	12,660	
Tenth spring	12.25	17,560	
	12.17	18,000	
	9.75	45,500	
	9.68	46,200	Closed down.
	9.75	44,720	
	11.82	18,000	
	12.25	13,720	
Eleventh spring	12.25	18,000	
At 38,800 pounds the inner coil spring fractured at the second turn of coil.			
Twelfth spring	12.26	18,000	
	12.25	18,100	
	9.75	45,800	Closed down.
	11.87	18,000	
	12.25	14,340	
Thirteenth spring	12.38	18,000	
	12.25	19.740	
	9.75	48,000	
	9.65	49,700	Closed down.
	9.75	46,800	
	11.98	18,000	
	12.25	15,040	
Fourteenth spring	12.25	16,700	
	12.11	18,000	
	9.75	44,620	
	9.68	45,900	Closed down.
	9.75	43,800	
	11.72	18,000	
	12.25	12,340	
Fifteenth spring	12.25	16,520	
	12.09	18,000	
	9.75	42,800	
	9.55	45,200	Closed down.
	9.75	41,320	
	11.66	18,000	
	12.25	12,080	
Sixteenth spring	12.25	17,700	
	12.21	18,000	
	9.75	44,600	
	9.70	45,600	Closed down.
	9.75	44,300	
	11.83	18,000	
	12.25	13,800	
Seventeenth spring	12.25	15,080	
	11.98	18,000	
	9.75	44,200	
	9.67	45,000	Closed down.
	9.75	42,600	
	11.56	18,000	
	12.25	11,200	
Eighteenth spring	12.27	18,000	
	12.25	18,400	
	9.75	45,800	
	9.63	46,700	Closed down.
	9.75	44,760	
	11.85	18,000	
	12.25	14,200	

COMPRESSION TESTS—Continued.

Description.	Height.	Load sustained.	Remarks.
	Inches.	*Pounds.*	
Nineteenth spring	12.25	18,000	
	9.75	45,500	
	9.69	46,700	Closed down.
	9.75	45,000	
	11.90	18,000	
	12.25	13,580	
Twentieth spring	12.27	18,000	
	12.25	18,500	
	9.75	46,500	
	9.70	47,300	Closed down.
	9.75	46,500	
	11.89	18,000	
	12.25	14,400	

This spring was closed down and so remained for a period of 65 hours, after which the results were as follows:

Description.	Height.	Load sustained.	Remarks.
	9.70	47,300	
	9.75	46,000	
	11.83	18,000	
	12.25	13,620	
	11.89	18,000	
	9.75	46,300	
	9.70	47,300	Closed down.
	9.75	46,000	
	11.84	18,000	
	12.25	13,600	
	10.25	39,500	

This spring was loaded 100 times, compressing to 10″.25 and returning to 12″.25 height each time, after which the results were as follows:

Description.	Height.	Load sustained.	Remarks.
	10.25	39,180	
	11.86	18,000	
	12.25	13,700	
	11.89	18,000	
	9.75	47,000	Closed down.
	11.85	18,000	
	12.25	13,480	

COMPRESSION TEST OF SPRINGS FOR 8-INCH CARRIAGE.

Springs made at Watertown Arsenal.

DESCRIPTION OF ONE SPRING.

Exterior diameter of coil ... inches..	2.80
Diameter of bar ... do...	.50
Height of spring unloaded ... do...	6.30
Distance between coils ... do...	.40
Weight ...	3 pounds 4 ounces

No. of spring.	Initial height unloaded.	Closed down.		Final height unloaded.
		Load.	Height.	
	Inches.	*Pounds.*	*Inches.*	*Inches.*
1	6.30	2,780	4.14	6.03
2	6.18	2,600	4.17	6.00
3	6.30	2,740	4.20	6.10
4	6.20	2,650	4.11	6.05
5	6.30	2,700	4.16	6.10
6	6.23	2,740	4.26	6.11
7	6.40	2,600	4.16	6.12
8	6.24	2,780	4.11	6.03
9	6.31	2,760	4.09	6.12
10	6.14	2,720	4.15	5.95
11	6.29	2,780	4.17	6.10
12	6.18	2,600	4.17	5.93
13	6.22	2,780	4.12	6.00
14	6.24	2,700	4.17	6.05
15	6.31	2,560	4.15	5.96
16	6.45	3,000	4.15	6.20

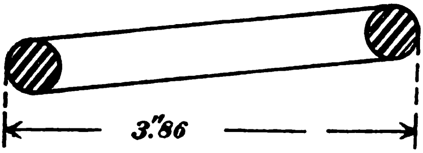
COMPRESSION TESTS OF HELICAL SPRINGS FOR 7-INCH MORTAR CARRIAGES.

Counter-recoil springs.
No. of test, 10354.

No. of spring.	Weight.		Exterior diameter.	Diameter of wire.	Height unloaded.	Distance between coils.	Height of spring when compressed at 1,000 pounds.	Closed down.		Height of spring when returned to 1,000 pounds.	Remarks.
								Load.	Height.		
	Lbs.	*ozs.*	*Inches.*	*Inch.*	*Inches.*	*Inch.*	*Inches.*	*Pounds.*	*Inches.*	*Inches.*	
1.....	19	3¼	5.02	.68	19.20	.80	15.93	2,900	9.56	15.20	
2.....	18	13¼	5.05	.68	19.10	.80	15.79	2,850	9.35	14.87	
3.....	18	14¼	5.00	.68	19.10	.80	15.73	2,780	9.45	14.87	
3.....	....		....	....	....	....	15.10	2,750	9.46	14.71	After being closed down 40¼ hours.
4.....	18	15	5.02	.68	19.12	.80	15.67	2,700	9.44	14.92	

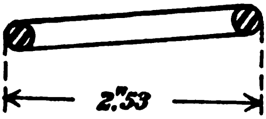
COMPRESSION TEST OF DOUBLE SPRING FROM RECOIL CYLINDER OF 15-POUNDER GUN FOR THE DRIGGS-SEABURY GUN AND AMMUNITION COMPANY, DERBY, CONN.

No. 10281.



OUTSIDE SPRING.

Seventeen coils; diameter of wire, ".560.
Free height, 18".41.



INSIDE SPRING.

Twenty-three coils; diameter of wire, ".377.
Free height, 17".33.

SPRINGS TESTED TOGETHER.

Load.			Height when closed.	Free heights.	Set of outside spring.	Set of inside spring.
Height 15 inches.	Height 10 inches.	Closed down.				
Pounds.	*Pounds.*	*Pounds.*	*Inches.*	*Inches.*	*Inch.*	*Inch.*
1,290	....	33,000	10.02	....	....	....

AFTER COMPRESSING THE SPRINGS FROM 15" TO 10" ONE HUNDRED TIMES.

1,190	33,000	33,000	10.00	18.24 16.95	.17	[illegible]

RECOIL SPRINGS FOR 3″ EXPERIMENTAL CARRIAGE, MANUFACTURED AT ROCK ISLAND ARSENAL.

No. 10311.

DESCRIPTION OF SPRING.

Exterior diameter of coil	inches	3.13
Diameter of bar	do	.37
Height unloaded	do	19.50
Distance between coils	do	.60
Weight		5 pounds 6¾ ounces

Height.	Load sustained.	Remarks.
Inches.	*Pounds.*	
17.81	100	Initial load.
17.26	150	Central rod 2¼″ diameter within the spring.
16.80	200	
16.33	250	Loads applied and released without jarring.
15.52	300	
14.99	350	
14.34	400	
13.58	450	
12.77	500	
10.87	600	
9.80	700	
8.79	800	
7.88	900	Closed down.
7.82	1,000	
7.81	900	
7.81	800	
8.12	700	
9.84	600	
11.39	500	
12.88	400	
14.47	300	
16.07	200	
17.70	100	
Spring continuously jarred with mallets as the loads were changed.		
17.70	100	Initial load.
16.03	200	
14.58	300	
13.08	400	
11.60	500	
10.42	600	
9.01	700	
7.86	800	Spring generally closed down, a few coils partly open.
7.81	820	
7.82	800	
8.54	700	
9.99	600	
11.50	500	
12.99	400	
14.65	300	
16.30	200	
17.88	100	
Center rod turned down to 2″ diameter.		
17.77	100	Initial load.
16.29	200	Loads applied and released without jarring.
14.71	300	
13.23	400	
11.60	500	
10.03	600	
8.47	700	
8.07	750	
7.79	800	Spring closed.
7.77	850	
7.79	800	
8.10	750	
8.58	700	
9.90	600	
11.48	500	
13.04	400	
14.68	300	
16.24	200	
17.93	100	
Center rod turned town to 1¾″ diameter.		
17.76	100	Initial load. Loads applied and released without jarring.
16 17	200	

No. 10311—Continued.

Height.	Load sustained.	Remarks.
Inches.	*Pounds.*	
14.57	300	
13.09	400	
11.51	500	
9.97	600	
8.84	700	
7.78	800	
8.80	700	
9.70	600	
11.19	500	
12.71	400	
14.50	300	
16.08	200	
17.78	100	
Spring in a yoke fixture having 4 side rods, the inside elements of which were on a circle 3¼″ diameter.		
17.66	100	Initial load.
16.12	200	Continuous jarring as loads were changed.
14.50	300	
12.93	400	
11.38	500	
9.64	600	
8.29	700	
7.82	750	
7.73	800	
7.77	750	
8.02	700	
8.93	600	
10.56	500	
12.08	400	
13.70	300	
15.30	200	
17.03	100	
....	0	
17.32	100	
7.74	800	
17.02	100	
....	0	
17.32	100	
....	0	Rested without load 1 hour.
17.74	100	Height under 100 pounds after resting.

No. 10312.

DESCRIPTION OF SPRING.

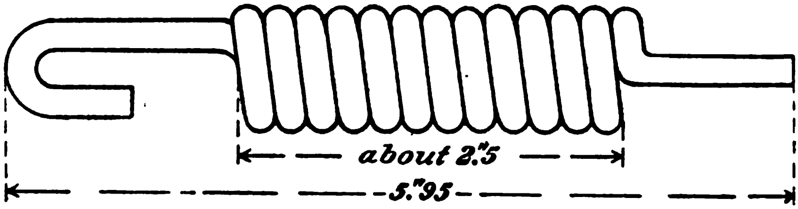
Exterior diameter of coil..inches.. 3.1
Diameter of bar..do.... .5
Height unloaded..do.... 19.5
Distance between coils..do.... .8
Weight.. 5 pounds 6¼ ounces.

Height.	Load sustained.	Remarks.
Inches.	*Pounds.*	
17.95	100	Initial load. Spring jarred continually with mallets as the loads were changed.
16.39	200	
14.89	300	
13.48	400	
11.89	500	Central rod 2¼″ diameter within the spring.
10.32	600	
8.61	700	
7.80	800	Spring generally closed down.
8.50	700	
10.20	600	
11.51	500	
13.08	400	
14.73	300	
16.27	200	
17.98	100	

No. 10312—Continued.

Height.	Load sustained.	Remarks.
Inches.	*Pounds.*	
17.93	100	Initial load. Loads applied and released without jarring.
16.70	200	
15.70	300	
14.99	400	
14.09	500	
12.93	600	
10.57	700	
9.54	800	
7.91	900	
7.91	800	
8.28	700	
9.87	600	
11.38	500	Rested under load three-fourths of an hour without change in height.
12.99	400	
14.68	300	
16.27	200	
17.96	100	
Center rod turned down to 2″ diameter.		
17.94	100	Initial load. Loads applied and released without jarring.
16.37	200	
14.80	300	
13.28	400	
11.80	500	
10.25	600	
8.70	700	
7.98	800	
8.40	700	
9.89	600	
11.52	500	
13.08	400	
14.71	300	
16.25	200	
17.98	100	
Spring in yoke fixture having 4 side rods, the inside elements of which were on a circle 3¼″ diameter.		
17.94	100	Continuous jarring as loads were changed.
16.34	200	
14.88	300	
13.16	400	
11.69	500	
10.12	600	
8.60	700	
8.08	800	
8.31	700	
9.15	600	
10.84	500	
12.46	400	
14.08	300	
15.70	200	
17.50	100	
8.08	800	
17.46	100	
....	0	Rested 16 hours.
17.94	100	
16.31	200	
14.73	300	
13.25	400	
11.73	500	
9.87	600	
8.50	700	
8.03	800	
8.37	700	
9.21	600	
10.63	500	
12.51	400	
14.02	300	
15.70	200	
17.49	100	

TENSION TESTS OF BRAKE LEVER SPRINGS FOR 12″ MORTAR CARRIAGE.



External diameter of springs, 1″.25.
Diameter of wire, ″.20.

No. of test.	Marks.	Height.		
		Unloaded.	Load of 244 pounds.	Unloaded.
		Inches.	*Inches.*	*Inches.*
10, 274	1	2.48	3.93	2.53
10, 275	11	2.47	3.92	2.55
10, 276	111	2.50	3.99	2.59
10, 277	1111	2.49	3.95	2.56
	Springs then loaded with 50 pounds.			
			Load of 50 pounds.	
10, 274	1	2.53	2.84	2.53
10, 275	11	2.55	2.84	2.55
10, 276	111	2.59	2.89	2.59
10, 277	1111	2.56	2.86	2.56

NICKEL STEEL.

TESTS MADE FOR THE BUREAU OF ORDNANCE, U. S. NAVY.

No. 7293.

Marks, 3″ round nickel steel. Carbon Steel Company.
Diameter, ″.500.
Sectional area, .196 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	0.	0.	
40,000	.00130	.00030	....	....	
48,000	.00150	.00020	....	....	Elastic limit.
49,000	.01100	.00950	....	....	
50,000	.01365	.00265	....	....	
51,000	.01450	.00085	....	....	
52,000	.01560	.00110	....	....	
54,000	.01750	.00190	....	....	
80,510	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,510
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2550
Elongation per inch under strain at elastic limit	do...	.00150
Reduction in diameter at point of rupture	do...	.150
Reduction in area after rupture, per cent of original section		50.9
Position of rupture		″.75 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.15, ″.36*

No. 7294.

Marks, 3″ round nickel steel. Carbon Steel Company.
Diameter, ″.500.
Sectional area, .196 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00100	.00040	0.	0.	
40,000	.00135	.00035	....	....	
48,000	.00155	.00020	....	....	Elastic limit.
49,000	.01350	.01195	....	....	
50,000	.01435	.00085	....	....	
51,000	.01495	.00060	....	....	
52,000	.01600	.00105	....	....	
53,000	.01700	.00100	....	....	
79,640	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....pounds..	79,6
Elastic limit per square inch of original section....do...	48,0
Elongation per inch after rupture....inch..	.50
Elongation per inch under strain at elastic limit....do...	.0015
Reduction in diameter at point of rupture....do...	.1
Reduction in area after rupture, per cent of original section....	[illegible]
Position of rupture....	″.8 from ce
Character of broken surface....	fine sil
Elongation of inch sections....	″.15, ″.5

No. 7295.

Marks, 3″ round nickel steel. Carbon Steel Company.
Diameter, ″.500.
Sectional area, .196 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020	....	....	
20,000	.00060	.00030	....	....	
30,000	.00100	.00040	0.	0.	
40,000	.00130	.00030	....	....	
48,000	.00150	.00020	....	....	
49,000	.00160	.00010	....	....	Elastic limit.
	.01200	.01040	....	....	
50,000	.01300	.00100	....	....	
51,000	.01395	.00095	....	....	
52,000	.01475	.00080	....	....	
53,000	.01650	.00175	....	....	
54,000	.01825	.00175	....	....	
80,710	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,710
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.00160
Reduction in diameter at point of rupture	do...	.140
Reduction in area after rupture, per cent of original section		48.1
Position of rupture		″.70 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.13, ″.33*

TESTS MADE FOR U. S. NAVY, GUN FACTORY, WASHINGTON, D. C.

Specimens taken from 1⅝″ round bars furnished by the Carbon Steel Company.

No. 7384.

Marks, 1.
Diameter, ″.500.
Sectional area, .196 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00030	.00020			
20,000	.00065	.00035			
30,000	.00100	.00035			
40,000	.00135	.00035	0.	0.	
50,000	.00160	.00025			
52,000	.00180	.00020			Elastic limit.
53,000	.00205	.00025			
54,000	.00325	.00120			
55,000	.00460	.00135			
56,000	.00595	.00135			
58,000	.00700	.00105			
60,000	.00875	.00175			
64,000	.01200	.00325			
68,000	.01575	.00375			
72,000	.01950	.00325			
76,000	.02400	.00450			
80,000	.03000	.00600			
93,870					Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds..	[illegible]
Elastic limit per square inch of original section.....do...	[illegible]
Elongation per inch after rupture.....inch..	[illegible]
Elongation per inch under strain at elastic limit.....do...	[illegible]
Reduction in diameter at point of rupture.....do...	[illegible]
Reduction in area after rupture, per cent of original section.....	[illegible]
Position of rupture.....	1″ from neck
Character of broken surface.....	granular 80 per cent, silky 20 per cent
Elongation of inch sections.....	″.05, ″.[illegible]

No. 7385.

Marks, 2.
Diameter, ″.500.
Sectional area, .196 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
30,000	.00100	.00035	....	....	
40,000	.00140	.00040	0.	0.	
45,000	.00170	.00030	....	....	Elastic limit.
46,000	.00400	.00230	....	....	
47,000	.00650	.00250	....	....	
48,000	.00900	.00250	....	....	
49,000	.00960	.00060	....	....	
50,000	.01060	.00100	....	....	
52,000	.01200	.00140	....	....	
56,000	.01675	.00475	....	....	
60,000	.02200	.00525	....	....	
64,000	.02800	.00600	....	....	
68,000	.03550	.00750	....	....	
72,000	.04350	.00800	....	....	
84,290	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,290
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.00170
Reduction in diameter at point of rupture	do...	.080
Reduction in area after rupture, per cent of original section		29.1
Position of rupture		at middle of stem
Character of broken surface		silky, oblique
Elongation of inch sections		″.21*, ″.19

No. 7386.

Marks, 3.
Diameter, ".500.
Sectional area, .196 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025			
20,000	.00065	.00030			
30,000	.00095	.00030			
40,000	.00130	.00035	0.	0.	
49,000	.00165	.00035			Elastic limit.
50,000	.01200	.01035			
51,000	.01275	.00075			
52,000	.01350	.00075			
54,000	.01525	.00175			
56,000	.01800	.00275			
60,000	.02375	.00575			
64,000	.03000	.00625			
68,000	.03850	.00850			
72,000	.05375	.01525			
82,400					Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	82,40
Elastic limit per square inch of original section .... do...	49,00
Elongation per inch after rupture .... inch..	.25
Elongation per inch under strain at elastic limit .... do...	.008
Reduction in diameter at point of rupture .... do...	.1
Reduction in area after rupture, per cent of original section	51
Position of rupture	at middle of ste
Character of broken surface	fine silky, cup-shape
Elongation of inch sections	".30*, .2

TABULATION OF TENSION SPECIMENS OF NICKEL STEEL.

Stems of specimens, 2" long, ".500 diameter.
Sectional area, .196 square inch.

No. of test.	Mark on specimen.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Pounds.	*Pounds.*	*Percent.*	*Percent.*		" "
7293	3" round N. steel....	48,000	80,510	25.5	50.9	Fine silky	.15, .36*
7294	3" round N. steel....	48,000	79,640	25.0	50.9	.....do	.15, .35*
7295	3" round N. steel....	49,000	80,710	23.0	48.1	.....do	.13, .33*
7384	1..................	52,000	93,370	6.5	7.6	Granular 80 per cent, silky 20 per cent.	.05, .08*
7385	2..................	45,000	84,290	20.0	29.1	Silky, oblique	.21*, .19
7386	3..................	49,000	82,400	25.5	51.0	Fine silky, cup-shaped.	.30*, .2

STEEL BARS

FOR

STANDARDIZING TESTING MACHINE AT THE WORKS OF THE DRIGGS-SEABURY GUN AND AMMUNITION COMPANY, DERBY, CONN.

No. 7374.

Marks, $\overset{2}{\mathrm{s}}\,\mathrm{s}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	....	....	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00100	.00040	....	....	
40,000	.00130	.00030	....	....	
50,000	.00165	.00035	....	....	
60,000	.00200	.00035	....	....	
70,000	.00245	.00045	....	....	
71,000	.00255	.00010	....	....	Elastic limit not well defined.
72,000	.00285	.00030	....	....	
73,000	.00315	.00030	....	....	
74,000	.00370	.00055	....	....	
75,000	.00425	.00055	....	....	
76,000	.00480	.00055	....	....	
77,000	.00530	.00050	....	....	
78,000	.00595	.00065	....	....	
80,000	.01375	.00780	....	....	
88,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,000
Elastic limit per square inch of original section		not well defined
Elongation per inch after rupture	inch..	.1750
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		51.9
Position of rupture		1″ from neck
Character of broken surface		fine silky, cup-shaped
Elongation of inch sections		″.25*, ″.10

No. 7375.

Marks, $\overset{4}{\text{s}}$ s
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00100	.00040	....	....	
40,000	.00135	.00035	....	....	
50,000	.00165	.00030	....	....	
60,000	.00200	.00035	....	....	
70,000	.00250	.00050	....	....	Elastic limit, approximately.
71,000	.00280	.00030	....	....	
72,000	.00300	.00020	....	....	
73,000	.00335	.00035	....	....	
74,000	.00385	.00050	....	....	
75,000	.00420	.00035	....	....	
76,000	.00480	.00060	....	....	
78,000	.00590	.00110	....	....	
80,000	.00805	.00215	....	....	
88,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	88,1
Elastic limit per square inch of original section (approximately) .... do...	70,0
Elongation per inch after rupture .... inch..	.17
Elongation per inch under strain at elastic limit .... do...	.00
Reduction in diameter at point of rupture .... do...	.1
Reduction in area after rupture, per cent of original section	51.
Position of rupture	″.95 from
Character of broken surface	fine silky, cup-shape
Elongation of inch sections	″.06, ″

No. 7376.

Marks, $\overset{6}{s}s$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Sucessive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5;000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00060	.00025	....	....	
30,000	.00095	.00035	....	....	
40,000	.00135	.00040	....	....	
50,000	.00165	.00030	....	....	
60,000	.00205	.00040	....	....	
69,000	.00245	.00040	....	....	
70,000	.00255	.00010	....	....	Elastic limit, approximately.
71,000	.00280	.00025	....	....	
72,000	.00300	.00020	....	....	
73,000	.00330	.00030	....	....	
74,000	.00370	.00040	....	....	
76,000	.00455	.00085	....	....	
80,000	.00850	.00395	....	....	
84,000	.02400	.01595	....	....	
88,300	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,300
Elastic limit per square inch of original section (approximately)	do...	70,000
Elongation per inch after rupture	inch..	.1750
Elongation per inch under strain at elastic limit	do...	.00255
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		51.9
Position of rupture		at the middle of the stem
Character of broken surface		fine silky, cup shaped
Elongation of inch sections		$\overbrace{''.17,\ ''.18}^{*}$

No. 7377.

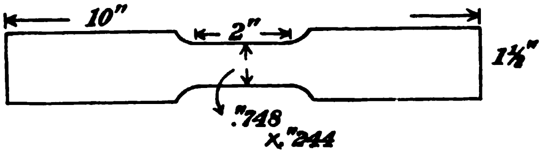
Marks, $\overset{8}{s}s$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.00010	.00010	0.	0.	
10,000	.00035	.00025	....	....	
20,000	.00065	.00030	....	....	
30,000	.00100	.00035	....	....	
40,000	.00145	.00045	....	....	
50,000	.00175	.00030	....	....	
60,000	.00210	.00035	....	....	
70,000	.00250	.00040	....	....	Elastic limit.
71,000	.00280	.00030	....	....	
72,000	.00300	.00020	....	....	
73,000	.00320	.00020	....	....	
74,000	.00365	.00045	....	....	
76,000	.00465	.00100	....	....	
80,000	.00875	.00410	....	....	
84,000	.02100	.01225	....	....	
88,100	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds..	88,100
Elastic limit per square inch of original section .... do...	70,000
Elongation per inch after rupture .... inch..	.1700
Elongation per inch under strain at elastic limit .... do...	.00250
Reduction in diameter at point of rupture .... do...	.155
Reduction in area after rupture, per cent of original section	51.9
Position of rupture	".8 from neck
Character of broken surface	fine silky, cup shaped
Elongation of inch sections	".07, ".27

TENSION TEST OF STEEL PLATE FOR U. S. QUARTERMASTER, WASHINGTON BARRACKS, D. C.



No of test.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	Sq. inch.	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		
10263	.182	*45,100	66,500	33.0	56.6	Silky	".24, ".42

*Approximate.

STEEL EYEBARS.

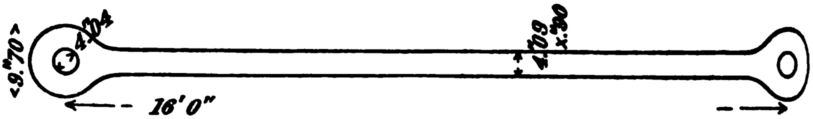
STEEL EYEBARS.

These bars were tested for Mr. George S. Morison, C. E., New York. They were made at the Pencoyd Iron Works, which furnished the following record of the physical test and chemical analysis of the material:

Heat, 10.4464.
Size, 4″ flat.
Dimensions of test piece, 1″.800 × ″.875.
Sectional area, 1.566 square inches.
Elastic limit, 38,380 pounds per square inch.
Tensile strength, 59,380 pounds per square inch.
Elongation in 8 inches, 2″.40 = 30 per cent.
Area at fracture, 1″.50 × ″.60 = .75 square inch.
Contraction of area, 52.1 per cent.
Appearance of fracture, silky, cup.
Bend, 180° flat.

Carbon, .20.
Sulphur, .04
Phosphorus, .02.
Manganese, .45.

No. 11397.



Sectional area, 3.681 square inches.
Gauged length, 160".

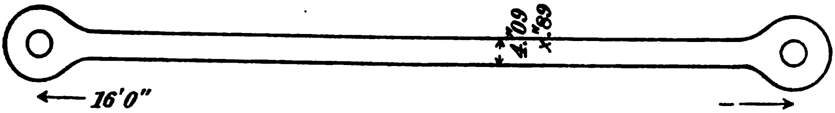
Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	
1,000	0.	0.	Initial load.
5,000	.0244	.0005	
10,000	.0529	.0008	
15,000	.0812	.0018	
16,000	.0867	....	
17,000	.0922	....	
18,000	.0978	....	
19,000	.1022	....	
20,000	.1090	.0017	
21,000	.1145	....	
22,000	.1208	....	
23,000	.1257	....	
24,000	.1316	....	
25,000	.1375	.0035	
26,000	.1435	....	
27,000	.1498	....	
28,000	.1562	....	Elastic limit.
29,000	.1653	....	
30,000	.1830	.0220	
31,000	.2222	....	
32,000	.7800	....	
	.8220	.6461	Elongation 2 seconds later than first observation.
33,000	1.03	....	
34,000	2.10	....	
35,000	2.97	....	
36,000	3.22	....	
37,000	3.44	....	
38,000	3.72	....	
39,000	3.98	....	
40,000	4.35	....	
41,000	4.67	....	
57,730	....	....	Tensile strength.
0	23.59	....	=14.7 per cent.

Elongation of pin holes, ".52 and ".96..

Elongation of 10-inch sections, 1.26, 1.60, 1.88, 1.50, 1.37, 1.34, 1.36, 1.34, 1.32, 1.39, 2.82*, 1.93, 1.21, 1.10, 1.07, 1.10.

Area at fracture, 3".00 × ".57 = 1.71 square inches.
Contraction of area, 53.5 per cent.
Fractured near middle of length of stem.
Appearance, silky.

No. 11400.



Sectional area, 3.64 square inches.
Gauged length, 160."

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	
1,000	0.	0.	Initial load.
5,000	.0229	.0004	
10,000	.0502	.0008	
15,000	.0775	.0011	
20,000	.1047	.0013	
21,000	.1100	....	
22,000	.1157	....	
23,000	.1214	....	
24,000	.1269	....	
25,000	.1324	.0021	
26,000	.1384	....	
27,000	.1449	....	
28,000	.1512	....	
29,000	.1585	....	Elastic limit.
30,000	.1765	.0196	
31,000	.3911	....	
32,000	.9400	....	
33,000	2.48	....	
34,000	3.10	....	
35,000	3.31	....	
36,000	3.55	....	
37,000	3.90	....	
38,000	4.15	....	
39,000	4.50	....	
40,000	4.84	....	
41,000	5.29	.502	
41,000	....	....	Elongation of 10-inch sections measured.
1,000	....	....	Elongation of 10-inch sections measured.
56,100	....	....	Tensile strength.
....	28.81	....	=18 per cent.

Elongation of 10-inch sections, 1.62, 3.48*, 2.84, 1.79, 1.63, 1.61, 1.62, 1.65, 1.61, 1.66, 1.95, 1.84, 1.41, 1.37, 1.31, 1.42.

Area at fracture, 3".01×."55 = 1.65 square inches.

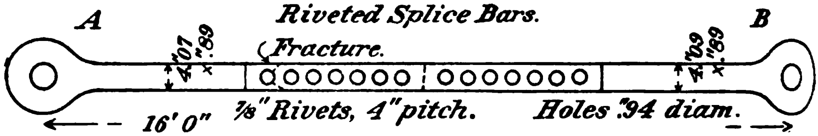
Contraction of area, 54.7 per cent.

Fractured in the second 10-inch section of the gauged length.

Appearance, silky.

The elongations of the 10-inch sections, while under 41,000 pounds per square inch tension on the bar were .34, .37, .36, .35, .36, .35, .35, .34, .35, .35, .34, .34, .31, .32, .33, .32, which measured, when the load was reduced to 1,000 pounds per square inch tension, .32, .35, .35, .34, .34, .33, .33, .33, .33, .33, .33, 32, .29, .30, .31, .30.

No. 11398.



Gross sectional area, 3.622 square inches.
Gauged length, 160".
Splice bars, 4" wide by ⅝" thick each.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0164	.0020	
5,000	.0163	.0024	Observation repeated.
6,000	.0207	....	
7,000	.0254	....	
8,000	.0300	....	
9,000	.0349	....	
10,000	.0394	.0036	
11,000	.0446	....	
12,000	.0494	....	
13,000	.0543	....	
14,000	.0591	....	
15,000	.0637	.0056	
16,000	.0689	....	
17,000	.0739	....	
18,000	.0788	....	
19,000	.0842	....	
20,000	.0890	.0079	
21,000	.0945	....	
22,000	.0998	....	
23,000	.1047	....	
24,000	.1104	....	
25,000	.1164	.0129	
26,000	.1255	....	
27,000	.1600	....	
28,000	.1940	....	
29,000	.2185	....	
30,000	.3250	.2038	
30,000	.3895	.2529	Observation repeated.
31,000	.6300	....	Scaling opposite end rivets and generally along the bar.
32,000	1.30	....	
33,000	2.06	....	
34,000	2.22	....	
35,000	2.40	....	
36,000	2.59	....	
37,000	2.84	....	
38,000	3.07	....	
39,000	3.36	....	
40,000	3.63	....	
41,000	3.97	....	Elongation of 10" sections measured.
1,000	....	....	Elongation of 10" sections measured.
45,640	....	....	Tensile strength.
0	5.81	....	= 3.6 per cent.

Elongation of pin holes, A ".41, B ".22.

Elongation of 10-inch sections, ".46, .43, .43, .43, .46, .80*, .02, .01, .11, .02, .44, .44, .45, .45, .44, .42.

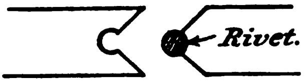
Area at fracture 2".70 net width by ".73 = 1.97 square inches.

Contraction of area, 45.6 per cent.

Fractured across first rivet hole, end A.

Appearance, silky.

Shape of fractured ends:

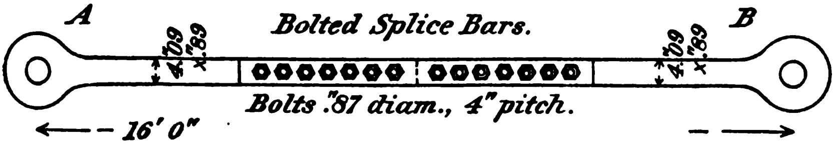


The elongations of the 10-inch sections while under 41,000 pounds per square inch tension on the bar were .37, .35, .35, .34, .37, .30, .03, .00, .08, .03, .30, .35, .36, .36, .35, .34, which measured, when the load was reduced to 1,000 pounds per square inch tension, .35, .34, .33, .32, .35, .29, .02, .02, .08, .02, .29, .34, .34, .34, .34, .32.

After the completion of the test the end rivet hole at end B measured 1″.24 diameter, taken lengthwise the bar. The rivet was partially sheared, the middle part having an offset of ″.08.

The rivet holes next the middle of the splice bars were very slightly distorted, the rivets in these holes showing only a fine line of demarcation between the eye-bar stems and splice bars.

No. 11399.



Sectional area, 3.64 square inch.
Gauged length, 160″.
Splice bars, 4″ wide by ⅝″ thick each.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	Inch.	Inch.	
1,000	0.	0.	Initial load.
2,000	.0129	....	
3,000	.0224	....	
4,000	.0323	....	
5,000	.0402	.0121	
6,000	.0472	....	
7,000	.0537	....	
8,000	.0597	....	
9,000	.0658	....	
10,000	.0716	.0162	
11,000	.0770	....	
12,000	.0833	....	
13,000	.0889	....	
14,000	.0959	....	
15,000	.1065	.0255	
16,000	.1178	....	
17,000	.1265	....	
18,000	.1338	....	
19,000	.1409	....	
20,000	.1489	.0447	
21,000	.1569	....	
22,000	.1643	....	
23,000	.1716	....	
24,000	.1782	....	
25,000	.1862	.0562	
26,000	.1993	....	

No. 11399—Continued.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
27,000	.2280		
28,000	.2715		
Rested under load for 20 minutes.			
29,000	.2870		
30,000	.3133		
31,000	.3400		
32,000	.4430		
33,000	.7930		
34,000	1.70		
35,000	2.20		
36,000	2.38		
37,000	2.50		
38,000	2.72		
39,000	2.93		
40,000	3.21		
41,000	3.54	3.28	
41,000			Elongation of 10″ sections measured.
1,000			Do.
48,100			Tensile strength.
0	5.98		=3.7 per cent.

Elongation of pin holes, A ″.45, B ″.32.

Elongation of 10-inch sections, ″.46, .44, .45, .44, .46, .79*, .03, .16, .01, .04, .47, .45, .46, .46, .44, .42.

Area at fracture, 2.78 net width by .74 = 2.057 square inches.

Contraction of area, 43.5 per cent.

Fractured across first bolt hole, end A.

Appearance, silky.

Elongation of bolt holes, .73*, .10, .04, .02, .01, .02, .01, .02, .01. .01, .01, .02, .01, .05, .11, .28.

The elongations of the 10-inch sections while under 41,000 pounds per square inch tension on the bar were, ″.31, .30, .30, .30, .30, .27, .02, .08, .00, .02, .29, .30, .30, .31, .29, .28, which measured when the load was released to 1,000 pounds tension, .29, .28, .29, .28, .29, .25, .01, .06, .00, .02, .27, .28, .29, .30, .28, .27.

WROUGHT IRON BARS.

EFFECTS OF OVERSTRAINING FOLLOWED BY INTERVALS OF REST.

WROUGHT IRON BARS.

EFFECTS OF OVERSTRAINING, FOLLOWED BY INTERVALS OF REST, ON THE TENSILE STRENGTH OF THE IRON.

The experiments were carried on with four kinds of wrought iron, Common Refined, Best Puddled, Burden's Best, and Norway. One test of each kind was made in the ordinary manner by the application of progressive loads, continued until rupture was reached. With the other specimens of the series an overstraining load was applied, ranging from 25,000 to 45,000 pounds per square inch with the different bars, which was followed by a period of rest under no load, and after different intervals resuming the loading until the tensile strength and rupture was reached. Generally the specimens displayed considerable elongation immediately after passing the primitive elastic limit, and when this rapid stretching had begun it continued for a time under diminished loads, thus making a jog in the stress-strain diagram, a feature quite common to ductile metal. These reduced loads and their elongations were not followed in many of the tests, but where large elongations are shown under loads just beyond the elastic limit, such specimens displayed the jog in their curves. The metal when under loads in the immediate vicinity of the elastic limit appears to be in a critical state as regards a tendency to elongate, and the reapplication of the same stress may cause rapid elongation, or after sustaining a load for a short time rapid elongation may set in.

The well-known effect of overstraining on the exaltation of the elastic limit is shown throughout the series. There is generally a less sharp definition of the secondary elastic limit, and also a less pronounced jog in the overstrained metal, but over a certain range of stresses beyond the primitive elastic limit deferred loads may be applied without causing a measurable increase in the permanent sets. The secondary elastic limits have been critically established as they are found in the "General summary" of the results, and appear lower than an inspection of the diagrams indicate, but higher loads showed a change in the rate of elongation, or repeated stresses caused slightly increased elongations.

The gain in elastic limit by overstraining ranged from 2,000 to 6,000 pounds per square inch. The influence on the results of the magnitude of the overstraining load, the amount of the permanent set, and the interval of rest is less prominently shown, but it appears that there is some gain after the longer periods of rest, and that higher stresses and sets are jointly attended with a gain in the value of the elastic limit. It is difficult also to trace how far beyond the limit of the overstraining load the influence of the rest extends, but an inspection of the stress-strain diagrams indicates that it may be felt throughout the remainder of the test in respect to elongation and tensile strength. The influence, if any, on the contraction of area is not apparent.

No. 7407.

Common Refined Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	
1,000	0.	0.	
5,000	.0014	0.	
10,000	.0032	0.	
15,000	.0050	....	
20,000	.0070	.0001	
25,000	.0088	.0001	
30,000	.0107	.0002	
31,000	.0111	....	**Elastic limit.**
31,500	.0375	....	
32,000	.0800	....	
33,000	.1910	....	
34,000	.23	....	
35,000	.26	....	
36,000	.29	....	
38,000	.37	....	
40,000	.46	....	
42,000	.59	....	
44,000	.75	....	
46,000	.99	....	
48,000	1.50	....	
48,220	....	....	Tensile strength.
0	1.90	....	=19 per cent.

Elongation of inch sections: ″.17, ″.15, ″.13, ″.14, ″.17, ″.18, ″.19, ″.17, ″.19, ″.41*.
Diameter at fracture, ″.93; area, .679 square inch.
Contraction of area, 32.1 per cent.
Appearance of fracture, fibrous, seamy.

No. 7411.

Common Refined Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10 inches.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0069	0.	
27,000	.0097	....	
27,800	....	....	Elastic limit.
28,000	.0110	....	
28,500	.0290	....	
29,000	.0590	....	
30,000	.0850	.0731	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0015	....	
10,000	.0034	....	
20,000	.0073	....	
28,000	.0103	....	
30,000	.0114	....	
30,500	.0305	....	
31,000	.0314	....	
32,000	.18	....	
33,000	.20	....	
34,000	.22	....	
36,000	.34	....	
38,000	.48	....	
40,000	.54	....	
42,000	.69	....	
43,020	....	....	Tensile strength.
0	.96	....	= 9.6 per cent.

Elongation of inch section: ″.08, ″.09, ″.31*, ″.08, ″.08, ″.05, ″.07, ″.06, ″.07, ″.07.

Diameter at fracture, 1″.00; area, .785 square inch.

Contraction of area, 21.5 per cent.

Appearance, dull, fibrous, seamy, spongy. Defective specimen.

No. 7414.

Common Refined Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauge length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0068	0.	
30,000	.0102	0.	
34,000	.0122	....	Elastic limit.
34,100	.1250	....	
34,500	.1900	....	
85,000	.2030	.1890	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0015	....	
10,000	.0034	....	
20,000	.0074	....	
30,000	.0111	....	
35,000	.0131	0.	
36,000	.0134	....	
37,000	.0138	....	
38,000	.0143	0.	
38,500	.0161	....	
39,000	.0193	....	
40,000	.1350	.1174	
41,000	.37	....	
42,000	.42	....	
43.000	.48	....	
44,000	.54	....	
45,000	.60	....	
46,000	.67	....	
47,000	.75	....	
48,000	.87	....	
49,000	.99	....	
50,000	1.28	....	
50,800	1.85	....	Tensile strength.
0	2.24	....	= 22.4 per cent.

Elongation of inch sections: ″.43*, ″.31, ″.24, ″.24, ″.22, ″.19, ″.17. ″.15, ″.16, ″.13.

Diameter at fracture, ″.90; area, .636 square inch.

Contraction of area, 36.4 per cent.

Appearance of fracture, fibrous, seamy.

No. 7412.

Common Refined Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0031	....	
20,000	.0070	0.	
30,000	.0105	0.	
35,000	.0127	.0002	
35,500	.0131	....	Elastic limit.
36,000	.0137 .1690	....	
37,000	.1900	....	
38,000	.25	....	
40,000	.32	.30+	
Rested without load 1 day.			
1,000	.0	.0	Micrometer reset at zero on the original gauged length.
5,000	.0015	....	
10,000	.0036	....	
20,000	.0078	....	
30,000	.0117	−.0002	
28,000	.0149	....	
40,000	.0157	....	
40,500	.0159	....	
41,000	.0161	....	
41,500	.0163	....	
42,000	.0165	....	
42,500	.0168	....	
43,000	.0170	....	
43,500	.0174	....	
44,000	.0182 .0196	....	
44,500	.0218	....	
45,000	.0285	....	
46,000	.51	....	
47,000	.54	....	
48,000	.61	....	
49,000	.68	....	
50,000	.79	....	
51,000	.90	....	
52,000	1.05	....	
53,000	1.30	....	
53,930	1.85	....	Tensile strength.
0	2.27	....	=22.7 per cent.

Elongation of inch sections: ″.18, ″.24, ″.48*, ″.25, ″.20, ″.19, ″.19, ″.18, ″.18, ″.18.

Diameter at fracture, ″.90; area, .636 square inch.

Contraction of area, 36.4 per cent.

Appearance of fracture, dull, fibrous, trace of granulation.

No. 7413.

Common Refined Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0031	....	
20,000	.0069	0.	
30,000	.0104	0.	
35,000	.0126	....	
35,400	....	....	Elastic limit.
35,500	.1400	....	
36,000	.2210	....	
38,000	.30	....	
40,000	.38	....	
42,000	.47	....	
45,000	.68	.66	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0016	....	
10,000	.0038	....	
20,000	.0079	....	
30,000	.0120	....	
40,000	.0164	0.	
43,000	.0174	....	
45,000	.0182	0.	
46,000	.0186	....	
47,000	.0190	0.	
48,000	.0194	....	
49,000	.0199	....	
49,500	.0204	....	
50,000	.0210 .0220	....	
51,000	.79	....	
52,000	1.08	....	
53,000	1.66	....	Tensile strength.
0	1.96	....	=19.6 per cent.

Elongation of inch sections: ″.14, ″.14, ″.16, ″.16, ″.18, ″21, ″.42, ″.23, ″.17, ″.15.

Diameter at fracture, ″.92; area, .665 square inch.

Contraction of area, 33.5 per cent.

Appearance of fracture, fibrous.

No. 7427.

Common Refined Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0067	0.	
30,000	.0102	0.	
31,000	.0107	....	
31,600	....	....	Elastic limit.
32,000	.0550	....	
33,000	.1150	....	
34,000	.2040	....	
35,000	.2406	.2254	
Rested without load 7 days.			
1,000	0.	0.	
5,000	.0006	0.	
10,000	.0029	....	
20,000	.0059	....	
30,000	.0090	....	
35,000	.0106	0.	Micrometer reset at zero on 8″ of the original gauged length.
38,000	.0114	....	
39,000	.0120	0.	
40,000	.0125	.0004	
40,500	.0131 .0217	....	
41,000	.1100	....	
41,000	.38	....	
42,000	.39	....	
44,000	.51	....	
46,000	.61	....	
48,000	.76	....	
50,000	1.02	....	
51,600	....	....	Tensile strength.
0	1.58	....	=15.8 per cent.

Elongation of inch sections: ″.12, ″.12, ″.12, ″.14, ″.13, ″.15, ″.13, ″.17, ″.24*, ″.26.

Diameter at fracture, ″.97; area, .739 square inch.

Contraction of area, 26.1 per cent.

Appearance of fracture, fibrous, seamy.

No. 7428.

Common Refined Iron.
Diameter, 1''.129.
Sectional area, 1 square inch.
Gauged length, 10''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0068	0.	
30,000	.0102	0.	
33,000	.0116 .1690	....	Elastic limit.
34,000	.1850	....	
36,000	.27	....	
38,000	.34	....	
40,000	.43	.41	
Rested without load 8 days.			
1,000	0.	0.	Micrometer reset at zero on 8'' of the original gauged length.
5,000	0.0011	0.	
10,000	.0027	....	
20,000	.0059	....	
30,000	.0091	....	
40,000	.0121	−.0003	
45,000	.0137	−.0003	
46,000	.0144	+.0001	
46,500	.0147	....	
47,000	.1444	....	
47,000	.60	....	
48,000	.63	....	
50,000	.75	....	
52,000	.92	....	
54,000	1.23	....	
54,800	1.80	....	Tensile strength.
0	2.21	....	= 22.1 per cent.

Elongation of inch sections: ''.15, ''.18, ''.20, ''.23, $\overbrace{''.39,\ ''.33,}^{*}$ ''.21, ''.18, ''.18, ''.16.
Diameter at fracture, ''.90; area, .636 square inch.
Contraction of area, 36.4 per cent.
Appearance of fracture, fibrous.

No. 7429.

Common Refined Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0018	0.	
10,000	.0031	....	
20,000	.0070	....	
30,000	.0108	0.	
35,000	.0129	.0003	Elastic limit.
36,000	.1925	....	
38,000	.27	....	
40,000	.34	....	
42,000	.42	....	
44,000	.53	....	
45,000	.60	.58	
Rested without load 8 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0013	0.	
10,000	.0032	....	
20,000	.0065	....	
30,000	.0100	....	
40,000	.0132	....	
45,000	.0150	0.	
48,000	.0159	0.	
50,000	.0167	.0002	
50,500	.0173	....	
51,000	.0176	....	
51,500	.0179	....	
52,000	.1750	....	
52,000	.79	....	
53,000	.83	....	
54,000	.93	....	
56,000	1.14	....	
57,400	1.65	....	Tensile strength.
0	1.93	....	= 19.3 per cent.

Elongation of inch sections: ″.15, ″.20, ″.42*, ″.23, ″.19, ″.17, ″.15, ″.14, ″.15, ″.13.

Diameter at fracture, ″.95; area, .709 square inch.

Contraction of area, 29.1 per cent.

Appearance of fracture, fibrous, trace of granulation.

No. 7408.

Best Puddled Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	....	
10,000	.0030	0.	
15,000	.0049	....	
20,000	.0067	0.	
25,000	.0084	....	
30,000	.0104	0.	
31,000	.0110	....	
32,000	.0115	....	
32,600	....	....	Elastic limit.
32,700	.1910	....	
33,000	.2050	....	
34,000	.25	....	
35,000	.29	....	
36,000	.33	....	
38,000	.40	....	
40,000	.51	....	
42,000	.65	....	
44,000	.84	....	
46,000	1.10	....	
48,000	1.70	....	
48,300	2.10	....	Tensile strength.
0	2.70	....	= 27 per cent.

Elongation of inch sections: ″.18, ″.20, ″.22, ″.22, ″.27, ″.49*, ″.28, ″.33, ″.31, ″.20.

Diameter at fracture, ″.90; area, .636 square inch.

Contraction of area, 36.4 per cent.

Appearance, fibrous.

No. 7415.

Best Puddled Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0031	....	
20,000	.0067	0.	
30,000	.0103	.0001	
30,800	....	....	Elastic limit.
31,000	.1250	....	
32,000	.1690	....	
33,000	.23	....	
34,000	.25	....	
35,000	.29	.28	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0011	....	
10,000	.0028	....	
20,000	.0070	....	
30,000	.0108	....	
35,000	.0127	−.0002	
36,000	.0132	....	
37,000	.0136	....	
37,500	.0140 .0145	....	
38,000	.0156	....	
38,500	.0167	....	
39,000	.0196	....	
40,000	.1480	.1312	
41,000	.47	....	
42,000	.52	....	
44,000	.63	....	
46,000	.79	....	
48,000	1.04	....	
49,600	1.65	....	Tensile strength.
0	1.89	....	=18.9 per cent.

Elongation of inch sections: ″.13, ″.15, ″.16, ″.16, ″.23, ″.46*, ″.16, ″.14, ″.15, ″.15.

Diameter at fracture, ″.90; area, .636 square inch.

Contraction of area, 36.4 per cent.

Appearance of fracture, fibrous.

No. 7416.

Best Puddled Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0032	....	
20,000	.0070	....	
30,000	.0106	.0001	
31,000	.0111	....	Elastic limit.
31,100	.1250	....	
31,500	.1490	....	
32,000	.1600	....	
33,000	.20	....	
34,000	.24	....	
36,000	.30	....	
38,000	.41	....	
40,000	.52	.50	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0013	....	
10,000	.0032	....	
20,000	.0075	....	
30,000	.0116	....	
40,000	.0157	0.	
41,000	.0162	....	
42,000	.0165	....	
43,000	.0170	0.	
44,000	.0178	....	
44,500	.0191	....	
45,000	.0200	....	
45,500	.0229	....	
46,000	.1990	.1768	
47,000	.78	....	
48,000	.82	....	
49,000	.92	....	
50,000	1.08	....	
50,900	1.40	....	Tensile strength.
0	1.55	....	= 15.5 per cent.

Elongation of inch sections: ″.13, ″.13, ″.13, ″.13, ″.16, ″.32*, ″.20, ″.12, ″.12, ″.11.

Diameter at fracture, ″.95; area, .709 square inch.

Contraction of area, 29.1 per cent.

Appearance of fracture, fibrous, seamy.

No. 7417.

est Puddled Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied ads per quare inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0032	....	
20,000	.0070	....	
30,000	.0111 .0700	....	Elastic limit.
31,000	.1150	....	
32,000	.1720	....	
34,000	.26	....	
36,000	.34	....	
38,000	.42	....	
40,000	.52	....	
42,000	.67	....	
45,000	.95	.93	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0008	....	
10,000	.0024	....	
20,000	.0073	....	
30,000	.0115	....	
40,000	.0149	....	
45,000	.0170	0.	
46,000	.0175	....	
47,000	.0180	....	
48,000	.0183	....	
48,500	.0186	....	
49,000	.0190	....	
49,500	.0193	....	
50,000	.0201	....	
50,500	.0277	....	
51,000	....	....	Tensile strength.
0	1.09	....	= 10.9 per cent.

longation of inch sections: ″.24*, ″.13, ″.09, ″.09, ″.10, ″.08, ″.09, , ″.09, ″.09.

iameter at fracture, ″.92; area, .665 square inch.

ontraction of area, 33.5 per cent.

ppearance, fibrous, seamy, trace of granulation. Fractured at the .

No. 7430.

Best Puddled Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0031	....	
20,000	.0069	....	
30,000	.0109	.0001	
32,700	....	....	Elastic limit.
33,000	.1570	....	
34,000	.1890	....	
35,000	.25	.24	
Rested without load 8 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0058	....	
30,000	.0089	....	
35,000	.0102	0.	
38,000	.0112	0.	
40,000	.0119	0.	
40,500	.0121	....	
41,000	.1090	....	
41,000	.37	....	
42,000	.40	....	
44,000	.49	....	
46,000	.57	....	
48,000	.70	....	
50,000	.88	....	
52,000	1.18	....	
53,200	1.90	....	Tensile strength.
0	2.25	....	=22.5 per cent.

Elongation of inch sections: ″.16, ″.17, ″.19, ″.22, ″.44*, ″.34, ″.18, ″.19, ″.19, ″.16.

Diameter at fracture, ″.87; area, .594 square inch.

Contraction of area, 40.6 per cent.

Appearance of fracture, fibrous.

No. 7431.

est Puddled Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied ads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0014	0.	
10,000	.0038	....	
20,000	.0071	....	
30,000	.0110	.0001	
32,000	.0118	....	Elastic limit.
32,500	.1860	....	
33,000	.1980	....	
34,000	.25	....	
36,000	.32	....	
38,000	.42	....	
40,000	.58	.51	
Rested without load 8 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0060	....	
30,000	.0095	....	
40,000	.0126	0.	
45,000	.0144	0.	
46,000	.0148	....	
46,500	.0450	....	
47,000	.1515	....	
47,000	.70	....	
48,000	.73	....	
50,000	.87	....	
52,000	1.08	....	
58,600	....	....	Tensile strength.
0	1.56	....	=15.6 per cent.

longation of inch sections: ″.11, ″.12, ″.12, ″.14, ″.20, ″.39*, ″.13,
, ″.12, ″.11.
iameter at fracture, ″.92; area, .665 square inch.
ontraction of area, 33.5 per cent.
ppearance, fibrous, seamy.

No. 7432.

Best Puddled Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0014	0.	
10,000	.0033	....	
20,000	.0070	....	
30,000	.0110	.0008	Elastic limit.
30,000	.1240	....	Second application.
32,000	.20	....	
34,000	.27	....	
36,000	.35	....	
38,000	.43	....	
40,000	.55	....	
42,000	.69	....	
44,000	.87	....	
45,000	1.01	.99	
Rested without load 8 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0013	0.	
10,000	.0032	....	
20,000	.0068	....	
30,000	.0103	....	
40,000	.0138	....	
45,000	.0156	0.	
50,000	.0175	0.	
51,000	.0179	....	
52,000	.0188	....	
	.0490	....	
53,000	.2520	.2290	
53,000	1.29	....	
54,000	1.32	....	
55,000	1.54	....	Tensile strength.
0	1.61	....	=16.1 per cent.

Elongation of inch sections: ″.15, ″.14, ″.14, ″.15, ″.15, ″.15, ″.15, ″.16, ″.16, ″.26*.
Diameter at fracture, 1″.01; area, .801 square inch.
Contraction of area, 19.9 per cent.
Appearance of fracture, fibrous, seamy.

No. 7409.

rden's Best Iron.
ameter, 1''.129.
ctional area, 1 square inch.
uged length, 10''.

pued ls per uare nch.	In gauged length.		Remarks.
	Elongation.	Set.	
unds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0011	....	
0,000	.0027	....	
5,000	.0045	....	
0,000	.0063	−.0001	
5,000	.0082	....	
0,000	.0106	.0007	Elastic limit.
0,000	.2020	....	Load reapplied.
1,000	.24	....	
2,000	.27	....	
3,000	.30	....	
4,000	.33	....	
6,000	.40	....	
8,000	.50	....	
0,000	.60	....	
2,000	.74	....	
4,000	.98	....	
6,000	1.25	....	
8,000	2.15	....	Tensile strength.
0	2.73	....	=27.3 per cent.

ongation of inch sections: ''.20, ''.27, ''.53*, ''.32, ''.27, ''.24, ''.24, ''.24, ''.17.
ameter at fracture, ''.88; area, .608 square inch.
ntraction of area, 39.2 per cent.
pearance, fibrous.

No. 7418.

Burden's Best Iron.
Diameter, 1".129.
Sectional area, 1 square inch.
Gauged length, 10".

Applied loads per square inch.	In guaged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0069	....	
29,000	.0103	....	Elastic limit.
29,200	.1950	....	
30,000	.2140	.2030	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0007	....	
10,000	.0016	....	
20,000	.0064	....	
30,000	.0102	....	
31,000	.0106	....	
32,000	.0110	....	
32,500	.0112	....	
33,000	.0137	....	
33,500	.0145	....	
34,000	.0163	....	
34,500	.1046	....	
35,000	.34	....	
36,000	.39	....	
38,000	.47	....	
40,000	.58	....	
42,000	.71	....	
44,000	.90	....	
46,000	1.37	....	
47,700	2.15	....	Tensile strength.
0	2.70	....	=27 per cent.

Elongation of inch sections: ".20, ".22, ".25, ".23, ".30, ".57*, ".3
".22, ".22, ".19.

Diameter at fracture, ".85; area, .567 square inch.
Contraction of area, 43.3 per cent.
Appearance of fracture, fibrous.

No. 7419.

urden's Best Iron.
iameter, 1''.129.
ectional area, 1 square inch.
auged length, 10''.

pplied ads per quare nch.	In gauged length.		Remarks.
	Elongation.	Set.	
ounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0064	0.	
39,000	.0102	....	
29,600	....	....	Elastic limit.
29,700	.1920	....	
30,000	.2030	....	
32,000	.28	....	
35,000	.39	.37	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0007	....	
10,000	.0023	....	
20,000	.0063	....	
30,000	.0108	....	
35,000	.0128	....	
36,000	.0130	....	
37,000	.0135	....	
38,000	.0138	....	
38,500	.0142	....	
39,000	.0155	....	
39,500	.0910	....	
40,000	.1600	....	
41,000	.59	....	
42,000	.65	....	
44,000	.82	....	
46,000	1.08	....	
48,000	1.84	....	
48,100	2.25	....	Tensile strength.
0	2.85	....	=28.5 per cent.

longation of inch sections: ''.19, ''.24, ''.26, ''.26, ''.29, ''.43, ''.51*,
, ''.23, ''.17.
iameter at fracture, ''.84; area, .554 square inch.
ontraction of area, 44.6 per cent.
ppearance of fracture, fibrous.

No. 7420.

Burden's Best Iron.
Diameter, 1".129.
Sectional area, 1 square inch.
Gauged length, 10".

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012		
10,000	.0030		
20,000	.0064	0.	
25,000	.0082		
29,400			Elastic limit.
29,500	.1890		
30,000	.2030		
32,000	.28		
34,000	.34		
36,000	.42		
38,000	.50		
40,000	.63	.61	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on the original gauged length.
5,000	.0013		
10,000	.0031		
20,000	.0074		
30,000	.0114		
40,000	.0150		
41,000	.0154		
42,000	.0159	0.	
43,000	.0161		
44,000	.0163	0.	
44,500	.0169		
45,000	.2060		
46,000	.96		
47,000	1.10		
48,000	1.35		
48,920	2.15		Tensile strength.
0	2.78		=27.8 per cent.

Elongation of inch sections: ".20, ".24, ".25, " 28, ".39, ".51*, ".[illegible] ".25, ".21, ".19.

Diameter at fracture, ".86; area, .581 square inch.

Contraction of area, 41.9 per cent.

Appearance of fracture, fibrous.

No. 7433.

urden's Best Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied ads per quare inch.	In gauged length.		Remarks.
	Elongation.	Set.	
ounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0011	0.	
10,000	.0030	....	
20,000	.0067	0.	
29,500	.0101	....	Elastic limit.
29,800	.2110	....	
30,000	.2200	.2078	
Rested without load 7 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0011	0.	
10,000	.0026	....	
20,000	.0056	....	
30,000	.0085	0.	
34,700	.0102	....	
35,000	.0106	.0006	
35,000	.0814	....	Second application of load.
36,000	.34	....	
38,000	.42	....	
40,000	.50	....	
42,000	.61	....	
44,000	.75	....	
46,000	.96	....	
48,000	1.51	....	
48,560	1.98	....	Tensile strength.
0	2.59	....	=25.9 per cent.

longation of inch sections: ″.17, ″.20, ″.21, ″.22, ″.24, ″.25, ″.32, *, ″.24, ″.18.

iameter at fracture, ″.82; area, .528 square inch.

ontraction of area, 47.2 per cent.

ppearance of fracture, fibrous.

No. 7434.

Burden's Best Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0065	0.	
29,300	.0101	....	Elastic limit.
29,500	.1970	....	
30,000	.2083	.1960	
31,000	.24	....	
32,000	.27	....	
33,000	.30	....	
34,000	.34	....	
35,000	.38	.37	
Rested without load 7 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0013	0.	
10,000	.0027	....	
20,000	.0059	....	
30,000	.0090	....	
35,000	.0106	0.	
39,000	.0120	....	
40,000	.0127	.0006	
40,000	.0134	....	Second application of load.
41,000	.51	....	
42,000	.55	....	
44,000	.66	....	
46,000	.81	....	
48,000	1.09	....	
49,000	1.30	....	
49,560	1.83	....	Tensile strength.
0	2.58	....	=25.8 per cent.

Elongation of inch sections: ″.17, ″.21, ″.22, ″.23, ″.27, ″.57*, ″.28, ″.24, ″.20, ″.19.

Diameter at fracture, ″.85; area, .567 square inch.

Contraction of area, 43.3 per cent.

Appearance, fibrous.

No. 7435.

urden's Best Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied ds per quare nch.	In gauged length.		Remarks.
	Elongation.	Set.	
ounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0031	....	
20,000	.0067	0.	
29,400	.0101	....	Elastic limit.
29,500	.2273	....	
30,000	.2387	.2263	
31,000	.27	....	
32,000	.31	....	
34,000	.38	....	
36,000	.47	....	
38,040	.57	....	
40,000	.72	.70	
Rested without load 7 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0012	0.	
10,000	.0027	....	
20,000	.0060	....	
30,000	.0092	....	
40,000	.0124	0.	
45,000	.0138	0.	
45,500	.0144	....	
46,000	.0149	.0004	
46,500	.1738	....	
47,000	.1993	.1811	
47,000	.95	....	
48,000	1.02	....	
49,000	1.17	....	
50,000	1.38	....	
50,500	1.87	....	Tensile strength.
0	2.44	....	= 24.4 per cent.

longation of inch sections: ″.16, ″.18, ″.21, ″.20, ″.25, ″.52*, ″.36, , ″.19, ″.16.
iameter at fracture, ″.80; area, .503 square inch.
ontraction of area, 49.7 per cent.
ppearance of fracture, fibrous.

No. 7436.

Burden's Best Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0067	0.	
26,000	.0090	....	Load sustained 5 minutes.
26,500	.0094	....	Load sustained 5 minutes.
27,000	.0098	....	Elastic limit. Load sustained 2 minutes, then rapid elongation occurred and load fell.
24,800	.0233	....	
	.0242	....	
25,000	.0256	....	
25,500	.0272	....	
26,000	.0335	....	
26,500	.0420	....	
27,000	.0820	....	
25,500	.0890	....	
	.0990	....	
26,000	.1070	....	
26,500	.1230	....	
27,000	.1381	....	
27,500	.1420	....	
28,000	.1472	....	
29,000	.1735	....	
30,000	.1980	.1857	
Rested without load 50 days.			
1,000	0.	0.	
5,000	.0008	0.	
10,000	.0023	....	
20,000	.0054	0.	Micrometer reset at zero on 8″ of the original gauged length.
30,000	.0084	0.	
34,000	.0096	....	
35,000	.0105	.0005	
35,000	.0107	....	Second application of load.
35,400	.0526	....	
36,000	.28	....	
38,000	.36	....	
40,000	.42	....	
42,000	.49	....	
44,000	.59	....	
46,000	.73	....	
48,000	.95	....	
49,900	1.57	....	Tensile strength.
0	2.50	....	=25 per cent.

Elongation of inch sections: ″.18, ″.19, ″.20, ″.21, ″.23, ″.25, ″56*, ″.31, ″.21, ″.16.

Diameter at fracture, ″.85; area, .567 square inch.

Contraction of area, 43.3 per cent.

Appearance of fracture, fibrous.

No. 7437.

urden's Best Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied oads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0067	0.	
29,000	.0102	....	
29,100	....	....	Elastic limit.
25,000	.0220 .0285	....	
26,000	.0420	....	
27,000	.0800	....	
28,000	.1790	....	
29,000	.1950	....	
30,000	.2270	.2145	
32,000	.29	....	
34,000	.38	....	
35,000	.42	.40	
Rested without load 50 days.			
1,000	0.	0.	
5,000	.0010	....	
10,000	.0027	0.	
20,000	.0059	....	
30,000	.0089	....	
35,000	.0102	0.	Micrometer reset at zero on 8″ of the original gauged length.
39,000	.0111	....	
40,000	.0116	.0001	
41,000	.0128	.0006	
41,000	.0129	....	Second application of load.
41,200	.0820	....	
42,000	.55	....	
44,000	.62	....	
46,000	.71	....	
48,000	.85	....	
50,000	1.09	....	
51,400	2.10	....	Tensile strength.
0	2.58	....	=25.8 per cent.

longation of inch sections: ″.17, ″.22, ″.25, ″.51*, ″.38, ″.25, ″.24, , ″.19, ″.17.
iameter at fracture, ″.82; area, .528 square inch.
ontraction of area. 47.2 per cent.
ppearance, fibrous.

No. 7438.

Burden's Best Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0012	0.	
10,000	.0031	....	
20,000	.0067	0.	
26,000	.0089	....	Load sustained 5 minutes.
26,500	.0091	....	Do.
27,000	.0093	....	Do.
27,500	.0096	....	Do.
28,000	.0098	....	Elastic limit. Sustained one-half minute, then rapid elongation.
25,000	.0170	....	
	.0190	....	
26,000	.0350	....	
27,000	.0760	....	
28,000	.1700	....	
29,000	.1900	....	
30,000	.2225	.2100	
32,000	.29	....	
34,000	.36	....	
36,000	.44	....	
38,000	.54	....	
40,000	.69	.67	
Rested without load 51 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0014	0.	
10,000	.0029	....	
20,000	.0062	....	
30,000	.0094	−.0002	
40,000	.0126	−.0002	
44,000	.0139	....	
45,000	.0145	+.0001	
45,000	.0146	....	Second application of load.
46,000	.0152	....	
47,000	.0166	....	
47,100	.1000	.0850	
48,000	.1690	.1540	
48,000	.90	....	
49,000	.94	....	
50,000	1.03	....	
51,000	1.13	....	
52,000	1.30	....	
52,800	1.68	....	Tensile strength.
0	2.52	....	=25.2 per cent.

Elongation of inch sections: ″.16, ″.19, ″.25, ″.27, ″.25, ″.55*, ″.30. ″.20, ″.19, ″.16.

Diameter at fracture, ″.84; area, .554 square inch.

Contraction of area, 44.6 per cent.

Appearance of fracture, fibrous.

No. 7410.

orway Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied ads per quare inch.	In gauged length.		Remarks.
	Elongation.	Set.	
ounds.	*Inches*	*Inch.*	
1,000	0.	0.	
5,000	.0013	0.	
10,000	.0031	.0001	
15,000	.0047	....	
20,000	.0064	.0001	
25,000	.0083	....	
26,000	.0091	....	
26,200	....	....	Elastic limit.
26,300	.3350	....	
29,000	.48	....	
30,000	.51	....	
31,000	.55	....	
32,000	.62	....	
34,000	.74	....	
36,000	.90	....	
38,000	1.10	....	
40,000	1.50	....	
41,800	2.90	....	Tensile strength.
0	3.63	....	=36.3 per cent.

longation of inch sections: ″.28, ″.36, ″.97*, ″.41, ″.32, ″.28, ″.28, , ″.25, ″.21.
iameter at fracture, ″.60; area, .283 square inch.
ontraction of area, 71.7 per cent.
ppearance, fibrous.

No. 7421.

Norway Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0015	0.	
10,000	.0034	....	
20,000	.0300	.0231	Elastic limit below 20,000 pounds.
21,000	.0430	....	
22,000	.1200	....	
23,000	.23	....	
24,000	.25	....	
25,000	.29	.28	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0011	0.	
10,000	.0027	....	
20,000	.0058	....	
25,000	.0078	0.	
28,000	.0081	0.	
29,000	.0083	....	
29,500	.0086	.0002	
30,000	.0979	....	
31,000	.42	....	
32,000	.47	....	
34,000	.55	....	
36,000	.70	....	
38,000	.86	....	
40,000	1.14	....	
42,000	1.78	....	
42,520	2.45	....	Tensile strength.
0	3.37	....	=33.7 per cent.

Elongation of inch sections: ″.22, ″.25, ″.28, ″.28, ″.25, ″.25, ″.50, ″.78*, ″.32, ″.24.

Diameter at fracture, ″.61; area, .292 square inch.

Contraction of area, 70.8 per cent.

Appearance of fracture, fibrous.

No. 7422.

orway Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied loads, r square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
ounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0013	0.	
10,000	.0031	....	
20,000	.0069	0.	
25,000	.0095	.0001	Elastic limit.
25,000	.2770	....	Second application.
26,000	.31	....	
27,000	.36	....	
28,000	.40	....	
29,000	.44	....	
30,000	.50	.48	
Rested without load 1 day.			
1,000	0.	0.	
5,000	.0011	0.	
10,000	.0028	....	
20,000	.0060	....	
30,000	.0090	0.	Micrometer reset at zero on 8″ of the original gauged length.
33,000	.0099	....	
34,000	.0103	0.	
34,500	.0106	....	
35,000	.0111	.0006	
35,000	.0980	....	Second application.
35,000	.60	....	
36,000	.61	....	
37,000	.70	....	
38,000	.74	....	
40,000	.90	....	
42,000	1.20	....	
43,000	1.55	....	
44,000	2.15	....	Tensile strength.
0	3.57	....	=35.7 per cent.

longation of inch sections: ″.21, ″.26, ″.33, ″.87*, ″.48, ″.35, ″.32, , ″.24, ″.23.
iameter at fracture, ″.60; area .283 square inch.
ontraction of area, 71.7 per cent.
ppearance of fracture, fibrous.

No. 7423.

Norway Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0013	0.	
10,000	.0031	....	
20,000	.0071	.0001	
21,700	....	....	Elastic limit.
22,000	.0650	....	
23,000	.2130	....	
24,000	.25	....	
26,000	.33	....	
28,000	.40	....	
30,000	.48	....	
32,000	.59	....	
34,000	.70	....	
35,000	.81	.80	
Rested without load 1 day.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gaug length.
5,000	.0012	0.	
10,000	.0029	....	
20,000	.0062	....	
30,000	.0094	....	
35,000	.0110	0.	
36,000	.0114	....	
38,000	.0121	....	
39,000	.0125	0.	
40,000	.0129	.0002	
40,500	.0138	....	
41,000	.1550	....	
41,000	.99	....	
42,000	1.05	....	
43,000	1.15	....	
44,000	1.35	....	
44,900	2.15	....	Tensile strength.
0	3.20	....	= 32 per cent.

Elongation of inch sections: ″.20, ″.26, ″.30, ″.46, ″.78*, ″.29, ″.23, ″.23, ″.19.

Diameter at fracture, ″.64; area, .322 square inch.

Contraction of area, 67.8 per cent.

Appearance of fracture, fibrous.

No. 7424.

orway Iron.
iameter, 1″.129.
ectional area, 1 square inch.
auged length, 10″.

pplied oads, per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0015	0.	
10,000	.0031	....	
20,000	.0068	0.	
21,000	.0070	....	
22,800	....	....	Elastic limit.
22,000	.0078	.0008	
22,500	.2110	....	
23,000	.24	....	
24,000	.27	....	
25,000	.30	.29	
Rested without load 7 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gauged length.
5,000	.0010	0.	
10,000	.0025	....	
20,000	.0054	....	
25,000	.0067	....	
28,000	.0076	....	
29,000	.0079	....	
29,500	.0083	0.	
30,000	.0088 .0386	....	
31,000	.0955	....	
31,000	.41	....	
32,000	.44	....	
34,000	.52	....	
36,000	.60	....	
38,000	.71	....	
40,000	.89	....	
42,000	1.09	....	
44,000	1.60	....	
44,640	2.25	....	Tensile strength.
0	3.24	....	=32.4 per cent.

longation of inch sections: ″.20, ″.25, ″.32, ″.87*, ″.31, ″.26, ″.28, 9, ″.25, ″.21.
iameter at fracture, ″.65; area, .332 square inch.
ontraction of area, 66.8 per cent.
ppearance of fracture, fibrous.

No. 7425.

Norway Iron.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	
1,000	0.	0.	
5,000	.0015	0.	
10,000	.0032	....	
19,600	....	....	Elastic limit.
20,000	.0079	.0011	
20,500	.0165	....	
21,000	.1430	....	
22,000	.1570	....	
23,000	.20	....	
24,000	.23	....	
26,000	.29	....	
28,000	.37	....	
30,000	.46	.45	
Rested without load 7 days.			
1,000	0.	0.	Micrometer reset at zero on 8″ of the original gaug length.
5,000	.0011	0.	
10,000	.0026	....	
20,000	.0055	....	
30,000	.0084	....	
35,000	.0100	0.	
35,500	.0105	....	
36,000	.0108	....	
	.0993	....	
36,000	.57	....	
37,000	.59	....	
38,000	.64	....	
40,000	.73	....	
42,000	.85	....	
44,000	1.03	....	
46,000	1.50	....	
46,500	2.08	....	Tensile strength.
0	3.13	....	=31.3 per cent.

Elongation of inch sections: ″.19, ″.26, ″.28, ″.31, ″.85*, ″.35, ″
″.23, ″.22, ″.19.

Diameter at fracture, ″.65; area, .332 square inch.

Contraction of area, 66.8 per cent.

Appearance of fracture, fibrous.

No. 7426.

way Iron.
neter, 1″.129.
ional area, 1 square inch.
ged length, 10″.

ied per re n.	In gauged length.		Remarks.
	Elongation.	Set.	
ds.	*Inches.*	*Inch.*	
000	0.	0.	
000	.0013	0.	
000	.0031	0.	
000	.0069	....	
000	.0080	.0001	
000	.0089	.0003	Elastic limit.
000	.2770	....	Second application.
000	.33	....	
000	.36	....	
000	.41	....	
000	.49	....	
000	.60	....	
000	.73	....	
000	.82	.80	
sted without load 7 days.			
000	0.	0.	Micrometer reset at zero on 8″ of the original length.
000	.0012	0.	
000	.0029	....	
000	.0061	....	
000	.0093	....	
000	.0109	....	
000	.0126	.0001	
500	.0128	....	
000	.0131	.0005	
000	.1358	....	
000	.97	....	
000	.98	....	
000	1.06	....	
000	1.12	....	
000	1.20	....	
000	1.33	....	
000	1.55	....	
480	1.98	....	Tensile strength.
0	3.00	....	=30 per cent.

gation of inch sections: ″.19, ″.20, ″.22, ″.24, ″.31, ″.85*, ″.31,
.23, ″.20.
neter at fracture, ″.63; area, .312 square inch.
traction of area, 68.8 per cent.
earance of fracture, fibrous.
l at time of fracture, 31,800 pounds total.

GENERAL SUMMARY.

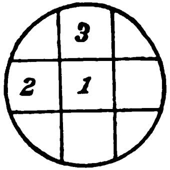
COMMON REFINED IRON.

No. of test.	Primitive elastic limit per square inch.	Over-straining load per square inch.	Permanent set.	Interval of rest.	Secondary elastic limit per square inch.	Gain per square inch.	Tensile strength per square inch.	Elongation.
	Pounds.	*Pounds.*	*Per cent.*	*Days.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
7407	31,000	....	....	....	....	....	48,220	19.
[a]7411	27,800	30,000	.781	1	30,000	0	43,020	9.6
7414	34,000	35,000	1.890	1	38,000	3,000	50,800	22.4
7412	35,500	40,000	3.0	1	43,500	3,500	53,930	22.7
7413	35,400	45,000	6.6	1	49,500	4,500	53,000	19.6
7427	31,600	35,000	2.254	7	39,000	4,000	51,600	15.8
7428	33,000	40,000	4.1	8	46,500	6,500	54,800	22.1
7429	35,000	45,000	5.8	8	50,000	5,000	57,400	19.3
BEST PUDDLED IRON.								
7408	32,600	....	....	....	....	....	48,300	27.
7415	30,800	35,000	2.8	1	37,000	2,000	49,600	18.9
7416	31,000	40,000	5.0	1	44,000	4,000	50,900	15.5
7417	30,000	45,000	9.3	1	49,500	4,500	51,000	10.9
7430	32,700	35,000	2.4	8	40,500	5,500	53,200	22.5
7431	32,000	40,000	5.1	8	46,000	6,000	53,600	15.6
7432	30,000	45,000	9.9	8	51,000	6,000	55,000	16.1
BURDEN'S BEST IRON.								
7409	30,000	....	....	....	....	....	48,000	27.3
7418	29,000	30,000	2.030	1	32,500	2,500	47,700	27.
7419	29,600	35,000	3.7	1	38,000	3,000	48,100	28.5
7420	29,400	40,000	6.1	1	44,000	4,000	48,920	27.8
7433	29,500	30,000	2.078	7	34,700	4,700	48,560	25.9
7434	29,300	35,000	3.7	7	39,000	4,000	49,560	25.8
7435	29,400	40,000	7.0	7	45,500	5,500	50,500	24.4
7436	27,000	30,000	1.857	50	34,000	4,000	49,900	25.
7437	29,100	35,000	4.0	50	40,000	5,000	51,400	25.8
7438	28,000	40,000	6.7	51	46,000	6,000	52,800	25.2
NORWAY IRON.								
7410	26,200	....	....	....	....	....	41,800	36.3
7421	<20,000	25,000	2.8	1	29,500	4,500	42,520	33.7
7422	25,000	30,000	4.8	1	34,500	4,500	44,000	35.7
7423	21,700	35,000	8.0	1	40,000	5,000	44,900	32.0
7424	22,800	25,000	2.9	7	29,500	4,500	44,640	32.4
7425	19,600	30,000	4.5	7	35,500	5,500	46,500	31.3
7426	25,000	35,000	8.0	7	40,500	5,500	48,480	30.0

[a] Defective specimen.

BRONZE.

SPECIMENS TAKEN FROM CASTINGS FROM THE ARSENAL FOUNDRY.



POSITION OF SPECIMENS IN THE CASTING, CONSOLE BRONZE.

Marks.	Description.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Specific gravity.	Elongation of inch sections.
		Pounds.	*Pounds.*	*Per cent.*	*Per cent.*			″ ″ ″ ″
1	Console bronze, not hammered	15,600	41,080	17.5	23.0	Light yellow, in part golden yellow	8.402	.15, .15, .16, .24*
2	....do	16,400	50,840	29.2	37.4	Light yellow	8.370	.25, .29, .29, .34*
3	....do	14 200	25,440	8.5	16.2	Light yellow, 40 per cent; spongy, copper colored, 60 per cent.	8.276	.04, .05, .07, .18*
1	Console bronze, hammered	23,800	52,280	19.3	23.0	Light yellow, dark-brown specks	8.368	.16, .17, .25*
2	....do	23,600	59,520	27.0	29.4	Uniform light yellow	8.380	.27, .32*, .22
3	....do	23,600	50,400	14.0	20.0	Light yellow, with golden-yellow spots	8.385	.12, .13, .17*
	Console bronze, forged	28,400	48,440	11.5	11.8	Light and golden yellow	....	.08, .15*
	Elevating worm wheel, unforged	11,500	19,550	15.0	13.2	Light yellow and lavender interspersed	....	.15*
2	Cylinder head	11,800	27,680	24.0	18.3	Golden and light yellow interspersed	....	.20, .28*
1	Cylinder head, console bronze, unforged	18,800	45,610	13.5	15.0	Light yellow	....	.12, .15*
2	....do	14,000	39,840	22.0	27.6	....do	....	.27*, .17
3	Cylinder head, forged	15,000	29,500	5.5	9.5	Light yellow and golden	....	.03, .08*
1	....do	14,000	29,000	7.5	13.2	....do	....	.06, .09*
6	Cylinder head, not forged	15,600	28,000	12.0	18.3	Yellow and golden, with brown spots	....	.08, .16*
7	....do	10,000	25,200	10.5	15.0	....do	....	.08, .13*
6 CH	Cylinder head	13,000	20,320	11.0	11.8	Dark copper colored and brown	....	.16*, .06
	Emptying coupling, 12″ disappearing carriage.	12,400	23,800	10.7	8.4	Yellow, with golden spots	....	.12, .10, .10
	Recoil cylinder, 12″ disappearing carriage	15,000	59,600	29.5	30.7	Light yellow, crystalline	....	.27, .32*
	Inner spring center, 7″ mortar	17,000	49,050	22.0	20.5	Yellow, with small dark spots	....	.19, .25*
	Recoil buffers, 6″ disappearing carriage	16,500	61,100	38.0	34.0	Golden oblique	....	.35, .41*
1	Recoil buffer	23,600	37,400	8.0	11.6	Light lemon yellow	....	.11*, .08, .05
2	....do	19,800	54,400	17.7	25.2	Uniform light yellow	....	.18, .16, .19
3	....do	21,200	54,320	36.7	36.4	....do	....	.41*, .30, .39

CONSOLE BRONZE—Continued.

Marks.	Description.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Specific gravity.	Elongation of inch sections.
		Pounds.	*Pounds.*	*Per cent.*	*Per cent.*			" " " "
	Recoil buffer, console metal	26,800	57,200	27.5	30.6	Uniform light yellow	....	.33*, .22
	Riser, forged from 3″ · 4″ to 1¼″ · 1¼″	21,200	50,840	44.7	47.2	Uniform light yellow, ¼″ seam at center	....	.57*, .41, .36
5	Riser, elevating, slide nut, forged	17,000	65,000	35.5	37.1	Uniform light yellow	....	.29, .42*
L	....	18,400	35,920	3.0	5.0	Golden, with dark spots	....	.02, .04
D	....	15,600	34,400	3.5	5.0	Golden, with yellow center	....	.02, .05
		20,400	48,000	7.0	8.4	Golden, with small yellow spot	....	.06, .08*

MANGANESE BRONZE.

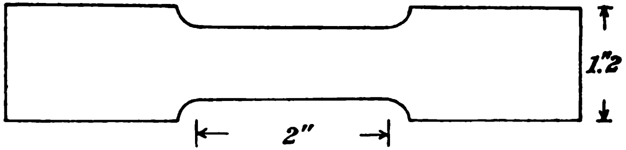
Marks.	Description.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Specific gravity.	Elongation of inch sections.
	5″ barbette cradle	20,000	37,560	4.5	11.8	Light yellow, golden spots, with 30 per cent dark brown, spongy.	....	.07*, .02
	.....do	20,000	72,500	34.0	27.4	Uniform light yellow	....	.30, .38*
	.....do	19,000	69,450	23.0	20.5	.....do	....	.23*
	Recoil spring centers, 7″ mortar	18,500	59,900	15.5	16.9	Light yellow, with black spots	....	.18*, .13

SPECIMENS FROM A 4-WAY HYDRAULIC CONNECTION, CAST BY THE WALWORTH MANUFACTURING COMPANY, BOSTON, MASS.

Marks.	Description.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Specific gravity.	Elongation of inch sections.
	Body	11,240	25,210	7.0	10.7	Uniform light yellow	....	.08*, .06
	Bracket	15,870	26,460	8.5	15.3	Light lavender yellow, opened cracks along the stem.	....	.07, .10*

HEIDEL'S METAL, FURNISHED BY THE GLOBE ELECTRIC COMPANY, ST. LOUIS, MO.

Plate 6″ by 6″ lettered: "Heidel's Metal, discovered Oct., 1898, St. Louis, Mo., U. S. A." Samples taken from each edge of plate.



No. of test.	Marks.	Dimensions.		Sectional area.	Tensile strength.		Elongation in 2 inches.		Area at fracture.	Contraction of area.	Fractures.	Chemical analysis.		
					Total.	Square inch.	Inch.	Per cent.				Aluminium.	Silicon.	Iron.
		Inch.	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*			*In.* *In.* *Sq. in.*	*Per cent.*				
10287	1	.750	.334	.250	2,580	10,320	.22	11.0	.68 × .30 = .204	18.4	Light silvery gray, amorphous, spongy near one surface.	99.2	.48	.28
10288	2	.748	.349	.261	2,720	10,420	.22	11.0	.68 × .32 = .218	16.5				

COPPER CYLINDERS FOR PRESSURE GAUGES.

Mean compression of 10 cylinders from Frankford Arsenal. Metal purchased November, 1900.

Table for use with crusher gauge one-tenth square inch area.

Mean dimensions of cylinders: Length, ″.4995; diameter, ″.2516.

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0042	.0040	.0040	.0035	.0040	.0039	.0042	.0015	.0046	.0037	.0038	.0036
9,000	.0146	.0143	.0147	.0140	.0140	.0142	.0145	.0117	.0150	.0139	.0141	.0136
10,000	.0185	.0182	.0178	.0174	.0183	.0182	.0186	.0160	.0181	.0174	.0179	.0173
11,000	.0224	.0220	.0215	.0215	.0215	.0226	.0226	.0193	.0219	.0217	.0217	.0211
12,000	.0264	.0260	.0259	.0251	.0260	.0265	.0266	.0235	.0260	.0254	.0257	.0250
13,000	.0305	.0305	.0298	.0294	.0303	.0305	.0310	.0278	.0300	.0294	.0299	.0291
14,000	.0354	.0343	.0340	.0339	.0342	.0349	.0346	.0316	.0345	.0339	.0341	.0332
15,000	.0390	.0385	.0386	.0375	.0381	.0385	.0396	.0356	.0390	.0382	.0383	.0373
16,000	.0435	.0430	.0429	.0421	.0429	.0430	.0438	.0402	.0435	.0423	.0427	.0416
17,000	.0491	.0472	.0475	.0464	.0472	.0480	.0483	.0446	.0475	.0470	.0473	.0462
18,000	.0528	.0522	.0526	.0510	.0520	.0521	.0530	.0489	.0526	.0515	.0519	.0508
19,000	.0572	.0565	.0572	.0554	.0565	.0569	.0578	.0532	.0575	.0563	.0565	.0554
20,000	.0619	.0614	.0618	.0595	.0615	.0619	.0629	.0589	.0624	.0610	.0613	.0602
21,000	.0670	.0658	.0664	.0645	.0665	.0668	.0675	.0639	.0670	.0658	.0661	.0650
22,000	.0718	.0711	.0719	.0693	.0709	.0715	.0724	.0688	.0718	.0710	.0711	.0700
23,000	.0770	.0765	.0761	.0745	.0763	.0768	.0770	.0736	.0770	.0757	.0761	.0750
24,000	.0815	.0814	.0813	.0795	.0805	.0820	.0826	.0785	.0820	.0810	.0810	.0798
25,000	.0870	.0863	.0860	.0840	.0860	.0860	.0869	.0838	.0870	.0856	.0859	.0847
26,000	.0918	.0915	.0908	.0900	.0914	.0920	.0920	.0885	.0920	.0912	.0911	.0899
27,000	.0976	.0969	.0965	.0941	.0961	.0966	.0976	.0947	.0971	.0970	.0965	.0953
28,000	.1022	.1020	.1020	.0994	.1010	.1027	.1026	.0995	.1028	.1012	.1015	.1003
29,000	.1088	.1072	.1071	.1051	.1069	.1068	.1084	.1048	.1078	.1065	.1069	.1057
30,000	.1128	.1125	.1119	.1100	.1120	.1126	.1127	.1098	.1130	.1112	.1118	.1106
31,000	.1181	.1175	.1179	.1160	.1175	.1179	.1180	.1146	.1190	.1159	.1172	.1161
32,000	.1246	.1230	.1225	.1210	.1220	.1233	.1230	.1197	.1235	.1235	.1226	.1214
33,000	.1288	.1286	.1277	.1265	.1289	.1282	.1290	.1259	.1287	.1271	.1279	.1267
34,000	.1341	.1340	.1335	.1309	.1336	.1345	.1340	.1308	.1345	.1328	.1333	.1321
35,000	.1396	.1393	.1386	.1373	.1385	.1385	.1396	.1364	.1394	.1385	.1386	.1372
36,000	.1450	.1445	.1430	.1420	.1443	.1440	.1445	.1411	.1452	.1435	.1437	.1423
37,000	.1506	.1498	.1475	.1475	.1490	.1488	.1498	.1468	.1493	.1489	.1488	.1474
38,000	.1558	.1550	.1537	.1532	.1540	.1544	.1550	.1530	.1563	.1543	.1545	.1531
39,000	.1615	.1604	.1589	.1576	.1600	.1597	.1600	.1576	.1605	.1585	.1595	.1581
40,000	.1668	.1663	.1644	.1631	.1648	.1658	.1655	.1615	.1655	.1646	.1648	.1634
41,000	.1719	.1710	.1698	.1679	.1698	.1694	.1705	.1668	.1698	.1690	.1696	.1682
42,000	.1761	.1759	.1742	.1732	.1742	.1754	.1750	.1723	.1755	.1748	.1747	.1733
43,000	.1822	.1808	.1801	.1786	.1794	.1794	.1799	.1771	.1798	.1794	.1797	.1783
44,000	.1874	.1859	.1844	.1834	.1847	.1850	.1855	.1826	.1847	.1843	.1848	.1834
45,000	.1925	.1910	.1891	.1878	.1891	.1890	.1904	.1878	.1895	.1891	.1895	.1881
46,000	.1971	.1952	.1936	.1932	.1943	.1944	.1945	.1925	.1950	.1937	.1944	.1930
47,000	.2026	.2005	.1990	.1980	.1994	.1994	.1994	.1970	.1993	.1992	.1994	.1980
48,000	.2066	.2058	.2035	.2031	.2043	.2033	.2050	.2015	.2037	.2036	.2040	.2026
49,000	.2105	.2095	.2078	.2076	.2085	.2085	.2090	.2058	.2085	.2080	.2084	.2070
50,000	.2149	.2143	.2125	.2119	.2128	.2125	.2130	.2105	.2125	.2118	.2127	.2113
51,000	.2194	.2181	.2164	.2163	.2173	.2165	.2176	.2148	.2168	.2161	.2169	.2155
52,000	.2233	.2222	.2210	.2200	.2211	.2211	.2215	.2183	.2210	.2210	.2211	.2197
53,000	.2275	.2264	.2248	.2245	.2256	.2251	.2255	.2230	.2255	.2250	.2253	.2239
54,000	.2310	.2306	.2284	.2278	.2289	.2288	.2290	.2268	.2285	.2284	.2288	.2274
55,000	.2346	.2345	.2322	.2320	.2330	.2324	.2333	.2302	.2329	.2323	.2327	.2313
56,000	.2377	.2374	.2362	.2350	.2368	.2362	.2365	.2346	.2364	.2360	.2363	.2350
57,000	.2423	.2415	.2398	.2388	.2404	.2399	.2403	.2379	.2399	.2400	.2401	.2388
58,000	.2452	.2450	.2429	.2424	.2435	.2432	.2434	.2416	.2430	.2424	.2433	.2420
59,000	.2488	.2476	.2465	.2455	.2471	.2470	.2475	.2448	.2465	.2465	.2468	.2455
60,000	.2521	.2515	.2500	.2490	.2502	.2498	.2498	.2479	.2496	.2495	.2499	.2486
61,000	.2550	.2568	.2530	.2530	.2535	.2530	.2531	.2511	.2528	.2523	.2534	.2521
62,000	.2578	.2603	.2560	.2550	.2564	.2560	.2568	.2540	.2560	.2556	.2564	.2551
63,000	.2606	.2628	.2590	.2580	.2595	.2588	.2594	.2569	.2589	.2589	.2593	.2580
64,000	.2639	.2658	.2619	.2610	.2625	.2622	.2628	.2600	.2612	.2615	.2623	.2610
65,000	.2663	.2670	.2645	.2635	.2648	.2639	.2650	.2628	.2648	.2638	.2646	.2633
66,000	.2689	.2682	.2674	.2666	.2675	.2670	.2679	.2650	.2670	.2670	.2673	.2660
67,000	.2714	.2712	.2703	.2690	.2705	.2695	.2705	.2675	.2699	.2691	.2699	.2686
68,000	.2741	.2742	.2729	.2715	.2730	.2725	.2730	.2705	.2724	.2719	.2726	.2713
69,000	.2764	.2760	.2754	.2743	.2758	.2752	.2756	.2729	.2748	.2741	.2751	.2739
70,000	.2785	.2784	.2780	.2767	.2779	.2774	.2780	.2754	.2769	.2770	.2774	.2762
71,000	.2812	.2810	.2801	.2790	.2805	.2802	.2805	.2775	.2794	.2793	.2799	.2787
72,000	.2832	.2836	.2823	.2816	.2825	.2823	.2825	.2802	.2818	.2814	.2821	.2809
73,000	.2856	.2857	.2848	.2836	.2849	.2850	.2848	.2826	.2845	.2839	.2845	.2833
74,000	.2877	.2878	.2866	.2860	.2873	.2870	.2869	.2845	.2864	.2860	.2866	.2854

Load per square inch on crusher gauge $\frac{1}{18}$ square inch area.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
75,000	.2897	.2900	.2886	.2884	.2893	.2886	.2895	.2865	.2884	.2880	.2887	.2875
76,000	.2920	.2920	.2911	.2905	.2915	.2913	.2918	.2892	.2905	.2903	.2910	[illegible]
77,000	.2937	.2943	.2933	.2922	.2935	.2933	.2934	.2908	.2925	.2930	.2930	.2918
78,000	.2958	.2961	.2951	.2943	.2956	.2950	.2954	.2935	.2945	.2945	.2950	.2938
79,000	.2978	.2980	.2970	.2961	.2975	.2970	.2976	.2952	.2970	.2963	.2970	.2958
80,000	.3000	.3000	.2990	.2983	.2995	.2987	.2992	.2970	.2985	.2984	.2989	.2977
81,000	.3037	.3020	.3011	.3002	.3013	.3010	.3010	.2989	.3005	.3002	.3010	[illegible]
82,000	.3055	.3038	.3030	.3020	.3033	.3030	.3028	.3006	.3025	.3017	.3028	.3016
83,000	.3074	.3055	.3050	.3036	.3049	.3050	.3050	.3029	.3040	.3037	.3047	.3035
84,000	.3089	.3073	.3067	.3058	.3070	.3066	.3064	.3044	.3059	.3056	.3065	.3055
85,000	.3105	.3090	.3081	.3074	.3083	.3084	.3084	.3060	.3075	.3074	.3081	.3071
86,000	.3123	.3105	.3102	.3093	.3104	.3102	.3099	.3079	.3098	.3090	.3099	[illegible]
87,000	.3140	.3118	.3120	.3105	.3118	.3120	.3115	.3095	.3115	.3106	.3115	.3105
88,000	.3149	.3135	.3136	.3125	.3130	.3135	.3130	.3112	.3125	.3125	.3130	.3120
89,000	.3167	.3151	.3150	.3141	.3149	.3149	.3149	.3127	.3140	.3138	.3146	[illegible]
90,000	.3187	.3168	.3166	.3154	.3166	.3167	.3165	.3144	.3155	.3150	.3162	.3152
91,000	.3202	.3184	.3180	.3169	.3183	.3182	.3180	.3157	.3172	.3167	.3178	[illegible]
92,000	.3218	.3201	.3200	.3185	.3193	.3202	.3198	.3178	.3186	.3180	.3494	.3185
93,000	.3233	.3217	.3211	.3202	.3209	.3214	.3209	.3189	.3200	.3196	.3208	.3199
94,000	.3247	.3227	.3224	.3212	.3226	.3225	.3224	.3200	.3218	.3210	.3221	.3212
95,000	.3261	.3244	.3235	.3230	.3238	.3242	.3238	.3215	.3232	.3226	.3238	.3229
96,000	.3294	.3258	.3260	.3244	.3253	.3255	.3254	.3228	.3245	.3237	.3253	.3244
97,000	.3308	.3271	.3264	.3258	.3270	.3269	.3267	.3244	.3259	.3252	.3266	.3257
98,000	.3319	.3284	.3283	.3270	.3280	.3284	.3281	.3260	.3264	.3266	.3279	.3270
99,000	.3327	.3297	.3295	.3282	.3292	.3297	.3292	.3272	.3282	.3278	.3291	.3282
100,000	.3340	.3306	.3310	.3296	.3307	.3308	.3305	.3284	.3296	.3292	.3304	.3295

Mean compression of 10 copper cylinders for crusher gauges for the Bureau of Ordnance, U. S. Navy, Washington, D. C.

Table for use with crusher gauge one-thirtieth square inch area.

Mean dimensions of cylinders: Length, ".1500; diameter, ".2060.

Load per square inch on crusher gauge $\frac{1}{30}$ square inch area.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
51,000	.0220	.0226	.0221	.0233	.0221	.0224	.0226	.0224	.0213	.0221	.0223	.0191
52,000	.0226	.0232	.0230	.0238	.0230	.0235	.0240	.0235	.0222	.0231	.0232	.0200
53,000	.0237	.0241	.0238	.0245	.0242	.0247	.0248	.0244	.0234	.0241	.0242	.0210
54,000	.0244	.0252	.0247	.0254	.0250	.0255	.0255	.0250	.0240	.0251	.0250	.0218
55,000	.0253	.0263	.0258	.0265	.0259	.0263	.0265	.0261	.0250	.0261	.0260	.0228
56,000	.0260	.0273	.0266	.0274	.0269	.0272	.0276	.0270	.0261	.0270	.0269	.0237
57,000	.0272	.0282	.0274	.0283	.0280	.0280	.0287	.0279	.0270	.0279	.0279	.0247
58,000	.0280	.0289	.0285	.0292	.0288	.0289	.0295	.0288	.0277	.0289	.0287	.0255
59,000	.0288	.0303	.0295	.0310	.0298	.0300	.0305	.0298	.0286	.0298	.0298	.0266
60,000	.0302	.0319	.0305	.0317	.0308	.0310	.0317	.0309	.0295	.0306	.0309	.0277
61,000	.0310	.0324	.0311	.0322	.0315	.0317	.0323	.0321	.0305	.0315	.0316	.0284
62,000	.0320	.0330	.0320	.0330	.0328	.0329	.0331	.0328	.0315	.0324	.0325	.0293
63,000	.0326	.0335	.0331	.0339	.0334	.0338	.0343	.0340	.0325	.0335	.0335	.0303
64,000	.0336	.0345	.0341	.0348	.0344	.0347	.0350	.0346	.0334	.0343	.0343	.0311
65,000	.0345	.0355	.0352	.0355	.0349	.0354	.0357	.0352	.0344	.0352	.0351	.0319
66,000	.0352	.0365	.0358	.0363	.0358	.0363	.0365	.0361	.0353	.0360	.0360	.0328
67,000	.0361	.0373	.0368	.0379	.0367	.0371	.0374	.0371	.0363	.0369	.0370	.0338
68,000	.0369	.0380	.0374	.0384	.0375	.0380	.0383	.0378	.0374	.0384	.0378	.0346
69,000	.0380	.0390	.0381	.0392	.0383	.0391	.0392	.0386	.0380	.0390	.0386	.0354
70,000	.0388	.0400	.0390	.0399	.0393	.0400	.0400	.0392	.0388	.0400	.0395	.0363
71,000	.0396	.0411	.0400	.0405	.0404	.0405	.0409	.0404	.0395	.0411	.0404	.0372
72,000	.0404	.0418	.0413	.0416	.0411	.0414	.0415	.0414	.0402	.0419	.0413	.0381
73,000	.0415	.0423	.0421	.0424	.0420	.0421	.0424	.0422	.0411	.0426	.0421	.0389
74,000	.0425	.0430	0430	.0435	.0425	.0430	.0430	.0429	.0420	.0431	.0429	.0397
75,000	.0429	.0439	.0435	.0443	.0436	.0436	.0440	.0438	.0425	.0438	.0436	.0404
76,000	.0435	.0445	.0444	.0448	.0443	.0446	.0449	.0445	.0431	.0444	.0443	.0411
77,000	.0448	.0456	.0450	.0459	.0454	.0456	.0455	.0450	.0442	.0452	.0452	.0420
78,000	.0455	.0464	.0457	.0464	.0458	.0462	.0466	.0461	.0453	.0460	.0460	.0428
79,000	.0464	.0470	.0464	.0474	.0464	.0466	.0472	.0469	.0460	.0468	.0467	.0435
80,000	.0475	.0474	.0473	.0481	.0470	.0476	.0480	.0475	.0466	.0474	.0474	.0442
81,000	.0479	.0484	.0482	.0487	.0479	.0487	.0487	.0481	.0474	.0480	.0482	.0450
82,000	.0484	.0491	.0490	.0494	.0488	.0494	.0494	.0486	.0480	.0488	.0489	.0457
83,000	.0491	.0497	.0495	.0500	.0495	.0500	.0500	.0495	.0488	.0495	.0496	.0464
84,000	.0493	.0506	.0503	.0507	.0500	.0505	.0507	.0505	.0497	.0500	.0503	.0471
85,000	.0501	.0513	.0508	.0513	.0506	.0512	.0515	.0510	.0504	.0508	.0509	.0477
86,000	.0512	.0517	.0514	.0521	.0514	.0519	.0521	.0515	.0510	.0514	.0516	.0484
87,000	.0519	.0525	.0521	.0530	.0521	.0527	.0529	.0524	.0515	.0520	.0523	.0491
88,000	.0526	.0535	.0531	.0537	.0528	.0533	.0538	.0531	.0525	.0528	.0531	.0499
89,000	.0533	.0540	.0540	.0543	.0535	.0539	.0544	.0536	.0530	.0536	.0538	.0506
90,000	.0542	.0546	.0546	.0550	.0548	.0550	.0550	.0545	.0535	.0544	.0546	.0514
91,000	.0548	.0555	.0551	.0558	.0550	.0556	.0554	.0550	.0540	.0549	.0551	.0519
92,000	.0552	.0560	.0557	.0564	.0556	.0563	.0560	.0556	.0548	.0554	.0557	.0525
93,000	.0557	.0565	.0564	.0575	.0562	.0568	.0565	.0565	.0555	.0562	.0564	.0532
94,000	.0561	.0574	.0569	.0580	.0567	.0573	.0570	.0571	.0563	.0569	.0570	.0538
95,000	.0571	.0581	.0575	.0584	.0572	.0581	.0580	.0576	.0570	.0574	.0576	.0544
96,000	.0577	.0584	.0584	.0589	.0581	.0585	.0587	.0581	.0580	.0580	.0583	.0551
97,000	.0585	.0590	.0587	.0594	.0587	.0594	.0592	.0588	.0584	.0586	.0589	.0557
98,000	.0588	.0596	.0593	.0600	.0592	.0601	.0597	.0592	.0589	.0592	.0594	.0562
99,000	.0593	.0602	.0600	.0606	.0596	.0608	.0604	.0597	.0593	.0597	.0600	.0568
100,000	.0599	.0607	.0607	.0612	.0602	.0612	.0609	.0603	.0598	.0603	.0605	.0573

Load per square inch on. crusher gauge $\frac{1}{10}$ square inch area.	Total compressions.										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
75,000	.2897	.2900	.2886	.2884	.2893	.2886	.2895	.2865	.2884	.2880	.2887
76,000	.2920	.2920	.2911	.2905	.2915	.2913	.2918	.2892	.2905	.2903	.2910
77,000	.2937	.2943	.2933	.2922	.2935	.2933	.2934	.2908	.2925	.2930	.2930
78,000	.2958	.2961	.2951	.2943	.2956	.2950	.2954	.2935	.2945	.2945	.2950
79,000	.2978	.2980	.2970	.2961	.2975	.2970	.2976	.2952	.2970	.2963	.2970
80,000	.3000	.3000	.2990	.2983	.2995	.2987	.2992	.2970	.2985	.2981	.2989
81,000	.3037	.3020	.3011	.3002	.3013	.3010	.3010	.2989	.3005	.3002	.3010
82,000	.3055	.3038	.3030	.3020	.3033	.3030	.3028	.3006	.3025	.3017	.3028
83,000	.3074	.3055	.3050	.3036	.3049	.3050	.3050	.3029	.3040	.3037	.3047
84,000	.3089	.3073	.3067	.3058	.3070	.3066	.3064	.3044	.3059	.3056	.3065
85,000	.3105	.3090	.3081	.3074	.3083	.3084	.3084	.3060	.3075	.3074	.3081
86,000	.3123	.3105	.3102	.3093	.3104	.3102	.3099	.3079	.3098	.3090	.3099
87,000	.3140	.3118	.3120	.3105	.3118	.3120	.3115	.3095	.3115	.3106	.3115
88,000	.3149	.3135	.3136	.3125	.3130	.3135	.3130	.3112	.3125	.3125	.3130
89,000	.3167	.3151	.3150	.3141	.3149	.3149	.3149	.3127	.3140	.3138	.3146
90,000	.3187	.3168	.3166	.3154	.3166	.3167	.3165	.3144	.3155	.3150	.3162
91,000	.3202	.3184	.3180	.3169	.3183	.3182	.3180	.3157	.3172	.3167	.3178
92,000	.3218	.3201	.3200	.3185	.3193	.3202	.3198	.3178	.3186	.3180	.3194
93,000	.3233	.3217	.3211	.3202	.3209	.3214	.3209	.3189	.3200	.3196	.3208
94,000	.3247	.3227	.3224	.3212	.3226	.3225	.3224	.3200	.3218	.3210	.3221
95,000	.3261	.3244	.3255	.3230	.3238	.3242	.3238	.3215	.3232	.3226	.3238
96,000	.3294	.3258	.3260	.3244	.3253	.3255	.3254	.3228	.3245	.3237	.3253
97,000	.3308	.3271	.3264	.3258	.3270	.3269	.3267	.3244	.3259	.3252	.3266
98,000	.3319	.3284	.3283	.3270	.3280	.3284	.3281	.3260	.3264	.3266	.3279
99,000	.3327	.3297	.3295	.3282	.3292	.3297	.3292	.3272	.3282	.3278	.3291
100,000	.3340	.3306	.3310	.3296	.3307	.3308	.3305	.3284	.3296	.3292	.3304

Mean compression of 10 copper cylinders for crusher gauges
Bureau of Ordnance, U. S. Navy, Washington, D. C.
Table for use with crusher gauge one-thirtieth square inch a
Mean dimensions of cylinders: Length, ".1500; diameter, ".

Load per square inch on crusher gauge $\frac{1}{30}$ square inch area.	Total compressions.										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
25,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
26,000	.0001	.0001	.0005	.0005	.0003	.0006	.0006	.0005	.0004	.0004	.0004
27,000	.0006	.0006	.0018	.0009	.0009	.0010	.0011	.0006	.0006	.0009	.0009
28,000	.0017	.0016	.0019	.0019	.0016	.0015	.0018	.0010	.0013	.0018	.0016
29,000	.0024	.0023	.0026	.0026	.0024	.0024	.0029	.0018	.0020	.0028	.0024
30,000	.0030	.0032	.0038	.0031	.0031	.0031	.0041	.0028	.0027	.0034	.0032
31,000	.0039	.0038	.0041	.0041	.0041	.0041	.0047	.0040	.0037	.0043	.0041
32,000	.0047	.0047	.0049	.0048	.0050	.0050	.0053	.0047	.0045	.0051	.0049
33,000	.0055	.0056	.0057	.0059	.0059	.0057	.0064	.0055	.0055	.0060	.0058
34,000	.0065	.0065	.0066	.0067	.0066	.0065	.0071	.0068	.0061	.0069	.0066
35,000	.0072	.0072	.0073	.0080	.0074	.0075	.0080	.0074	.0069	.0076	.0074
36,000	.0082	.0080	.0082	.0090	.0081	.0084	.0089	.0080	.0076	.0084	.0083
37,000	.0088	.0089	.0091	.0095	.0090	.0093	.0095	.0091	.0087	.0095	.0091
38,000	.0098	.0103	.0098	.0102	.0100	.0102	.0106	.0102	.0095	.0105	.0101
39,000	.0108	.0109	.0108	.0115	.0110	.0112	.0120	.0109	.0104	.0115	.0111
40,000	.0116	.0115	.0116	.0123	.0120	.0121	.0125	.0118	.0112	.0122	.0119
41,000	.0128	.0126	.0125	.0135	.0130	.0137	.0131	.0127	.0120	.0127	.0129
42,000	.0134	.0140	.0132	.0141	.0139	.0142	.0141	.0140	.0128	.0138	.0138
43,000	.0142	.0147	.0142	.0149	.0149	.0150	.0152	.0148	.0140	.0148	.0147
44,000	.0156	.0156	.0157	.0158	.0158	.0158	.0160	.0158	.0148	.0161	.0156
45,000	.0162	.0169	.0161	.0168	.0167	.0169	.0170	.0165	.0156	.0178	.0166
46,000	.0169	.0176	.0171	.0181	.0175	.0178	.0180	.0175	.0167	.0181	.0175
47,000	.0178	.0184	.0183	.0190	.0186	.0187	.0189	.0187	.0175	.0185	.0184
48,000	.0189	.0194	.0192	.0197	.0197	.0196	.0198	.0197	.0191	.0195	.0195
49,000	.0201	.0202	.0200	.0206	.0204	.0205	.0207	.0206	.0198	.0205	.0203
50,000	.0206	.0213	.0210	.0219	.0213	.0214	.0219	.0217	.0205	.0214	.0213

Total compressions.											Mean corrected sets.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
.0220	.0226	.0221	.0233	.0221	.0224	.0226	.0224	.0213	.0221	.0223	.0191
.0226	.0232	.0230	.0238	.0230	.0235	.0240	.0235	.0222	.0231	.0232	.0200
.0237	.0241	.0238	.0245	.0242	.0247	.0248	.0244	.0234	.0241	.0242	.0210
.0244	.0252	.0247	.0254	.0250	.0255	.0255	.0250	.0240	.0251	.0250	.0218
.0253	.0263	.0258	.0265	.0259	.0263	.0265	.0261	.0250	.0261	.0260	.0228
.0260	.0273	.0266	.0274	.0269	.0272	.0276	.0270	.0261	.0270	.0269	.0237
.0272	.0282	.0274	.0283	.0280	.0280	.0287	.0279	.0270	.0279	.0279	.0247
.0280	.0289	.0285	.0292	.0288	.0289	.0295	.0288	.0277	.0289	.0287	.0255
.0288	.0303	.0295	.0310	.0298	.0300	.0305	.0298	.0286	.0298	.0298	.0266
.0302	.0319	.0305	.0317	.0308	.0310	.0317	.0309	.0295	.0306	.0309	.0277
.0310	.0324	.0311	.0322	.0315	.0317	.0323	.0321	.0305	.0315	.0316	.0284
.0320	.0330	.0320	.0330	.0328	.0329	.0331	.0328	.0315	.0324	.0325	.0293
.0326	.0335	.0331	.0339	.0334	.0338	.0343	.0340	.0325	.0335	.0335	.0303
.0336	.0345	.0341	.0348	.0344	.0347	.0350	.0346	.0334	.0343	.0343	.0311
.0345	.0355	.0352	.0355	.0349	.0354	.0357	.0352	.0344	.0352	.0351	.0319
.0352	.0365	.0358	.0363	.0358	.0363	.0365	.0361	.0353	.0360	.0360	.0328
.0361	.0373	.0368	.0379	.0367	.0371	.0374	.0371	.0363	.0369	.0370	.0338
.0369	.0380	.0374	.0384	.0375	.0380	.0383	.0378	.0374	.0384	.0378	.0346
.0380	.0390	.0381	.0392	.0383	.0391	.0392	.0386	.0380	.0390	.0386	.0354
.0388	.0400	.0390	.0399	.0393	.0400	.0400	.0392	.0388	.0400	.0395	.0363
.0396	.0411	.0400	.0405	.0404	.0405	.0409	.0404	.0396	.0411	.0404	.0372
.0404	.0418	.0413	.0416	.0411	.0414	.0415	.0414	.0402	.0419	.0413	.0381
.0415	.0423	.0421	.0424	.0420	.0421	.0424	.0422	.0411	.0426	.0421	.0389
.0425	.0430	.0430	.0435	.0425	.0430	.0430	.0429	.0420	.0431	.0429	.0397
.0429	.0439	.0435	.0443	.0436	.0436	.0440	.0438	.0425	.0438	.0436	.0404
.0435	.0445	.0444	.0448	.0443	.0446	.0449	.0445	.0431	.0444	.0448	.0411
.0448	.0456	.0450	.0459	.0454	.0456	.0455	.0450	.0442	.0452	.0452	.0420
.0455	.0464	.0457	.0464	.0458	.0462	.0466	.0461	.0453	.0460	.0460	.0428
.0464	.0470	.0464	.0474	.0464	.0466	.0472	.0469	.0460	.0468	.0467	.0435
.0475	.0474	.0473	.0481	.0470	.0476	.0480	.0475	.0466	.0474	.0474	.0442
.0479	.0484	.0482	.0487	.0479	.0487	.0487	.0481	.0474	.0480	.0482	.0450
.0484	.0491	.0490	.0494	.0488	.0494	.0494	.0486	.0480	.0488	.0489	.0457
.0491	.0497	.0495	.0500	.0495	.0500	.0500	.0495	.0488	.0495	.0496	.0464
.0493	.0506	.0503	.0507	.0500	.0505	.0507	.0505	.0497	.0500	.0503	.0471
.0501	.0513	.0508	.0513	.0506	.0512	.0515	.0510	.0504	.0508	.0509	.0477
.0512	.0517	.0514	.0521	.0514	.0519	.0521	.0515	.0510	.0514	.0516	.0484
.0519	.0525	.0521	.0530	.0521	.0527	.0529	.0524	.0515	.0520	.0523	.0491
.0526	.0535	.0531	.0537	.0528	.0533	.0538	.0531	.0525	.0528	.0531	.0499
.0533	.0540	.0540	.0543	.0535	.0539	.0544	.0536	.0530	.0536	.0538	.0506
.0542	.0546	.0546	.0550	.0548	.0550	.0550	.0545	.0535	.0544	.0546	.0514
.0548	.0555	.0551	.0558	.0550	.0556	.0554	.0550	.0540	.0549	.0551	.0519
.0552	.0560	.0557	.0564	.0556	.0563	.0560	.0556	.0548	.0554	.0557	.0525
.0557	.0565	.0564	.0575	.0562	.0568	.0565	.0565	.0555	.0562	.0564	.0532
.0561	.0574	.0569	.0580	.0567	.0573	.0570	.0571	.0563	.0569	.0570	.0538
.0571	.0581	.0575	.0584	.0572	.0581	.0580	.0576	.0570	.0574	.0576	.0544
.0577	.0584	.0584	.0589	.0581	.0585	.0587	.0581	.0580	.0580	.0583	.0551
.0585	.0590	.0587	.0594	.0587	.0594	.0592	.0588	.0584	.0586	.0589	.0557
.0588	.0596	.0593	.0600	.0592	.0601	.0597	.0592	.0589	.0592	.0594	.0562
.0593	.0602	.0600	.0606	.0596	.0608	.0604	.0597	.0593	.0597	.0600	.0568
.0599	.0607	.0607	.0612	.0602	.0612	.0609	.0608	.0598	.0603	.0605	.0573

BRICKS.

MPRESSION TESTS OF WHOLE AND HALF BRICKS, WITH PLASTER OF PARIS, CARDBOARD, AND PINE-WOOD CUSHIONS.

BRICK.

These bricks were submitted for test by the Engineer Commissioner of the District of Columbia.

There are three series of tests each made on whole bricks and on half bricks. In the first series of each size the compressed surfaces were faced with plaster of paris, according to the usual methods employed at the arsenal. In series (*a*) the specimens were tested between cardboard cushions, ¼″ total thickness on each side, while in series (*b*) pine-wood cushions were used, ½″ thickness on each side. The cardboard and pine-wood cushions were used at the request of the Engineer Commissioner, District of Columbia. The same test number is used in the tests of whole bricks of a given manufacture, the subletters (*a*) and (*b*) referring to the tests with cardboard and pine-wood cushions, respectively.

The tests of the half bricks are designated in the same manner.

The average strength of the several groups, omitting from the comparison those samples of whole bricks in which there were no representatives in series (*b*) and comparing whole and half bricks of the same manufacture, are as follows:

Résumé of results.

	Mean strength.	Relative strength.
Tests of whole bricks:		
Set in plaster	9,060	100
Cardboard cushions	7,380	81
Pine-wood cushions	5,480	60
Tests of half bricks:		
Set in plaster	5,640	100
Cardboard cushions	4,430	79
Pine-wood cushions	4,540	81

Comparison of whole bricks with half bricks.

	Whole bricks.		Half bricks.	
	Mean strength.	Relative strength.	Mean strength.	Relative strength.
Set in plaster	6,990	100	5,640	81
Cardboard cushions	6,150	100	4,430	72
Pine-wood cushions	4,420	100	4,540	103

An examination of the details of the tests shows four individual cases in which the whole bricks between cardboard cushions surpassed the strength of bricks of the same manufacture which had plastered surfaces. Those tested between pine-wood cushions in every case were found below the corresponding plastered samples.

The half bricks with plastered surfaces surpassed individually those tested between cardboard cushions, but among those tested between pine-wood cushions there were instances of higher strength in the latter series.

Taking the general results, the superiority of the plastered specimens as a whole is apparent.

COMMON BRICK

WHOLE BRICKS.

Compressed surfaces faced with plaster of paris.

No. of test.	No. of brick.	Dimensions.			Sectional area.	First crack.	Ultimate st
		Height.	Compressed surface.				Total.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*
10313	1	2.50	4.22	8.43	35.57	86,000	186,900
10314	7	2.48	4.12	8.57	35.31	107,000	257,200
10315	13	2.33	3.99	8.47	33.80	269,000	309,500
10316	19	2.27	4.04	8.19	33.09	442,000	609,000
10317	22	2.30	4.02	8.19	32.92	93,000	446,100
10318	25	2.43	4.11	8.67	35.63	108,000	234,800
10319	28	2.32	4.09	8.36	34.19	191,000	361,500
10320	31	2.55	4.02	8.51	34.21	216,000	312,000
10321	34	2.41	4.18	8.48	35.45	143,000	181,000
10322	37	2.88	4.00	8.33	33.32	164,000	282,500
10323	43	2.46	4.12	8.57	35.31	63,000	224,500
10324	45	2.41	4.14	8.57	35.48	96,000	242,700
10325	48	2.48	4.15	8.59	35.65	175.000	229,900
10326	52	2.36	4.08	8.50	34.68	142,000	207,000
10327	54	2.60	4.05	8.49	34.38	144,000	175,700
10328	57	2.50	4.16	9.04	37.61	282,000	653,000
10329	60	2.45	4.25	8.92	37.91	138,000	686,000
10330	63	2.49	4,07	8.70	35.41	185,000	216,100
10331	69	2.57	4.10	8.50	34.85	153,000	180,600
10332	75	2.58	4.14	8.58	35.52	190,000	259,900
10333	81	2.37	4.20	8.54	35.87	148,000	219,800

WHOLE BRICKS. SERIES A.

Bricks placed between cushions of cardboard, four thickn $\frac{1}{16}''$ each.

Total thickness, $\frac{1}{4}''$ on each side of the brick.

No. of test.	No. of brick.	Dimensions.			Sectional area.	First crack.	Ultimate st
		Height.	Compressed surface.				Total.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*
10313*a*	2	2.50	4.27	8.44	36.04	39,900	169,100
10314*a*	8	2.42	4.11	8.54	35.10	77,300	201,200
10315*a*	14	2.38	4.03	8.48	34.17	169,100	211,300
10316*a*	20	2.32	4.04	8.26	33.37	356,200	394,300
10317*a*	23	2.34	3.92	8.34	32.69	32,100	514,900
10318*a*	26	2.38	4.05	8.40	34.02	61,800	210,100
10319*a*	29	2.32	3.99	8.22	32.80	32,300	257,200
10320*a*	32	2.56	3.97	8.68	34.46	94,500	207,300
10321*a*	35	2.42	4.16	8.47	35.24	35,400	177,900
10322*a*	38	2.21	3.96	8.19	32.43	4,200	292,400
10323*a*	44	2.48	4.19	8.59	35.99	72,000	169,300
10324*a*	46	2.50	4.20	8.65	36.33	93,000	170,200
10325*a*	49	2.55	4.06	8.55	34.71	121,000	197,900
10326*a*	53	2.35	4.06	8.46	34.35	4,500	131,400
10327*a*	55	2.60	4.22	8.55	36.08	91,000	139,400
10328*a*	58	2.47	4.27	9.05	38.64	38,800	443,200
10329*a*	61	2.46	4.22	8.92	37.64	181,500	476,400
10330*a*	64	2.48	4.11	8.66	35.59	71,000	193,800
10331*a*	70	2.52	4.10	8.47	34.73	4,000	154,300
10332*a*	76	2.60	4.10	8.50	34.85	125,000	263,800
10333*a*	82	2.36	4.17	8.47	35.32	3,000	218,100

WHOLE BRICKS. SERIES B

icks placed between cushions of pine wood (clear white-pine
) ½″ thick.
tal thickness, ½″ on each side of the brick.

. of st.	No. of brick.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
13*b*	3	2.50	4.26	8.40	35.78	31,000	102,100	2,850
14*b*	9	2.50	4.26	8.44	35.95	36,700	162,200	4,510
15*b*	15	2.38	4.02	8.46	34.01	108,000	227,300	6,680
16*b*	21	2.27	4.05	8.23	33.33	201,000	368,000	11,040
17*b*	24	2.31	3.97	8.18	32.47	198,000	331,900	10,220
18*b*	27	2.38	3.99	8.41	33.56	82,000	196,600	5,860
19*b*	30	2.85	4.02	8.34	33.53	52,000	191,000	5,700
20*b*	33	2.63	4.12	8.61	35.47	42,000	158,900	4,480
21*b*	36	2.43	4.15	8.49	35.23	45,500	166,100	4,710
22*b*	39	2.32	4.06	8.31	33.74	8,000	182,300	5,400
24*b*	47	2.40	4.09	8.55	34.97	31,000	117,800	3,370
25*b*	50	2.51*	4.07	8.67	35.29	25,000	117,700	3,340
27*b*	56	2.40	4.06	8.45	34.31	69,000	141,300	4,120
28*b*	59	2.53	4.10	9.13	37.43	257,000	346,800	9,270
29*b*	62	2.45	4.23	8.89	37.60	90,800	283,800	7,550
30*b*	65	2.51	4.18	8.81	36.83	35,000	112,700	3,060
31*b*	71	2.49	4.00	8.52	34.08	23,500	138,200	4,060
32*b*	77	2.59	4.17	8.55	35.65	79,000	156,800	4,400
33*b*	83	2.37	4.22	8.55	36.08	17,000	125,600	3,480

HALF BRICKS.

ch half of an entire brick tested.
mpressed surfaces faced with plaster of paris.

of st.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
334	4	2.52	4.25	4.14	17.60	39,800	83,400	4,740
335	4	2.50	4.25	4.21	17.89	48,500	87,300	4,880
336	10	2.42	4.15	4.34	18.01	55,000	111,800	6,210
337	10	2.38	4.15	4.24	17.60	36,000	102,700	5,840
338	16	2.39	4.15	4.20	17.43	59,000	119,600	6,860
339	16	2.39	4.14	4.33	17.93	82,000	147,500	8,230
340	40	2.36	4.12	4.16	17.14	73,000	101,300	5,910
341	40	2.32	4.12	4.16	17.14	68,000	100,400	5,860
342	66	2.53	4.17	4.30	17.93	80,500	85,900	4,790
343	66	2.52	4.15	4.44	18.43	49,900	93,800	5,090
344	72	2.46	4.09	4.21	17.22	65,000	85,600	4,970
345	72	2.46	4.09	4.26	17.42	84,000	95,700	5,490
346	78	2.60	4.16	4.23	17.60	63,000	86,200	4,900
347	78	2.61	4.17	4.25	17.72	59,000	92,100	5,200

HALF BRICKS. SERIES A.

Each half of an entire brick tested.
Compressed between cushions of card board.
Total thickness of card board each side of the brick, ¼″.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate stre
		Height.	Compressed surface.				Total.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*
10334*a*	5	2.48	4.26	3.77	16.06	34,200	53,700
10335*a*	5	2.50	4.26	4.27	18.19	53,000	76,800
10336*a*	11	2.44	4.10	4.22	17.30	30,000	71,300
10337*a*	11	2.42	4.11	4.31	17.71	22,300	76,600
10338*a*	17	2.38	4.03	4.25	17.13	31,000	106,200
10339*a*	17	2.37	4.06	4.19	17.01	66,800	107,400
10340*a*	41	2.36	3.96	4.17	16.51	28,000	87,200
10341*a*	41	2.37	3.98	4.07	16.20	35,200	92,800
10342*a*	67	2.49	4.06	4.31	17.50	46,000	70,100
10343*a*	67	2.46	4.09	4.39	17.96	41,500	67,800
10344*a*	73	2.58	4.19	4.29	17.98	56,800	66,900
10345*a*	73	2.60	4.18	4.34	18.14	64,000	77,800
10346*a*	79	2.58	4.29	4.28	18.36	40,000	58,100
10347*a*	79	2.57	4.29	4.32	18.53	23,000	65,300

HALF BRICKS. SERIES B.

Each half of an entire brick tested.
Compressed between cushions of pine wood.
Total thickness of wood each side of the brick, ½″.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate stre
		Height.	Compressed surface.				Total.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*
10334*b*	6	2.39	4.09	4.34	17.75	11,200	64,200
10335*b*	6	2.43	4.12	3.77	15.53	34,200	53,000
10336*b*	12	2.44	4.15	4.19	17.39	18,000	56,500
10337*b*	12	2.41	4.14	4.36	18.05	48,000	68,500
10338*b*	18	2.42	4.18	4.30	17.97	40,000	113,000
10339*b*	18	2.42	4.21	4.35	18.31	20,000	85,100
10340*b*	42	2.29	4.09	4.21	17.22	60,000	94,800
10341*b*	42	2.30	4.10	4.10	16.81	91,500	103,100
10342*b*	68	2.53	4.16	4.26	17.72	63,000	77,300
10343*b*	68	2.50	4.12	4.32	17.80	66,000	84,800
10344*b*	74	2.56	3.98	4.20	16.72	54,300	95,300
10345*b*	74	2.52	3.99	4.22	16.84	37,500	98,500
10346*b*	80	2.66	4.26	4.32	18.40	11,000	49,400
10347*b*	80	2.65	4.25	4.29	18.23	51,000	63,400

e following data were furnished by the Engineer Commissioner, ict of Columbia.

icks of the same kind and manufacture are tabulated in groups, ated from the others by an intervening space.

f k.	Kind.	Method of manufacture.	Color.	Water absorbed in 24 hours by weight.
				Per cent.
1	Paving	Machine; stiff mud; re-pressed; end cut	Medium red	13.8
2	do	do	do	13.7
3	do	do	do	14.1
4	do	do	do	13.1
5	do	do	do	14.0
6	do	do	do	10.1
7	do	do	do	11.1
8	do	do	do	9.6
9	do	do	do	14.1
0	do	do	do	10.5
1	do	do	do	11.0
2	do	do	do	10.9
3	do	Machine; stiff mud; side cut	Darker than average.	7.1
4	do	do	Medium red	8.6
5	do	do	do	9.1
6	do	do	do	11.7
7	do	do	do	8.9
8	do	do	do	11.3
9	Building	Machine; semidry	Buff, with light and dark brown specks.	5.3
0	do	do	do	5.9
1	do	do	do	6.2
2	do	Machine; stiff mud; side cut	Drab (no speckles)	0.5
3	do	do	do	0.3
4	do	do	do	0.18
5	do	do	Medium red	13.3
6	do	do	do	10.6
7	do	do	do	7.9
8	do	Machine; semidry; re-pressed	do	9.5
9	do	do	do	7.4
0	do	do	do	6.3
1	do	do	do	8.1
2	do	do	do	7.9
3	do	do	do	8.5
4	do	Hand; soft mud	do	11.0
5	do	do	do	10.4
6	do	do	do	10.0
7	do	do	do	7.2
8	do	do	do	5.8
9	do	do	do	6.4
0	do	do	do	9.4
1	do	do	do	6.3
2	do	do	do	6.4
3	do	Machine; semidry; re-pressed	With numerous streaks and blotches.	10.0
4	do	do	do	9.8
5	Sewer	do	do	10.9
6	do	do	do	13.7
7	do	do	do	9.6
8	do	Hand; soft mud	Darker than average.	7.7
9	do	do	do	7.6
0	do	do	do	8.4
1	do	do	do	9.1
2	do	do	do	8.9
3	do	do	do	8.4
4	do	Machine: semidry; re-pressed	Medium red	11.1

No. of brick.	Kind.	Method of manufacture.	Color.
55	Sewer	Machine; semidry; re-pressed	Medium red
56	do	do	do
57	Vitrified sewer.	Machine	Light brown, dark speckles.
58	do	do	do
59	do	do	do
60	do	do	Buff
61	do	do	do
62	do	do	do
63	Common	Machine; soft mud	Medium red
64	do	do	do
65	do	do	do
66	do	do	do
67	do	do	do
68	do	do	do
69	Sewer	Machine; semidry; re-pressed	do
70	do	do	do
71	do	do	do
72	do	do	do
73	do	do	do
74	do	do	do
75	do	do	do
76	do	do	do
77	do	do	do
78	do	do	do
79	do	do	do
80	do	do	Lighter than average.
81	do	Machine; stiff mud; side cut	Reddish brown on exterior and cherry red inside.
82	do	do	
83	do	do	

CEMENT.

CEMENT.

estigative work has been conducted with different brands of ts under the following heads:

mical analyses of composition of the material and cement rock.
eness of grinding.
cific gravity.
ermination of water and carbon dioxide in the material after ion.
e of setting.
perature acquired during setting.
rded sets.
avior during mixing of material with and without a "restrainer."
orption of water by grout mixtures and compressive tests.
s in weight of grouts set in air.
erial which set in air at different temperatures.
ngth after exposure to higher temperatures.
s on tensile and compressive strength.

following brands were used in these tests:

Brand.	Class.	Location of works.
a	Portland	Easton, Pa.
	do	Northampton, Pa.
gh	do	West Coplay, Pa.
	do	Siegfried, Pa.
n King	do	Akron, N. Y.
ehall	do	Cementon, Pa.
	do	Germany.
erhoff	do	Do.
n	do	Belgium.
	Slag	Chicago, Ill.
edral	Portland and sand composite	New York.
	Portland and limestone composite	Do.
n Star	Natural	Akron, N. Y.
n	do	Mankato, Minn.
eville Improved	do	Siegfried, Pa.
nan	do	Rosendale, N. Y.
ato	do	Mankato, Minn.
rk and Rosendale	do	Whiteport, N. Y.
n	do	Binnewater, N. Y.
sk	do	Akron, N. Y.
nac	do	

CHEMICAL ANALYSES OF CEMENTS.

Brand.	Class.	Silica.	Oxide of iron.	Alumina.	Limé.	Magnesia.	Oxides of sodium and potassium.	Sulphur trioxide.	Man ga- nou oxid
Alpha	Portland	20.60	2.91	11.20	59.00	3.25	....	1.40	0.3
Atlas	do	18.32	3.36	11.22	60.00	3.78	....	1.40	.....
Krause	do	20.76	1.76	6.68	62.00	4.63	....	1.21	.....
Lehigh	do	23.84	1.30	8.12	61.58	2.48	....	1.60	.....
Star, earlier manufacture.	do	22.00	2.76	9.67	57.00	3.42	....	2.07	.4
Star, with plaster.	do	22.00	2.50	9.00	59.90	3.50	....	1.98	.....
Star, without plaster.	do	22.45	2.53	9.27	60.27	3.59	....	.60	.....
Storm King	do	22.94	2.90	6.30	43.74	20.72	....	2.83	.....
Whitehall	do	20.30	2.95	10.87	62.15	2.51	....	1.10	.....
Alsen	do	20.42	2.10	11.00	57.50	2.53	....	2.26	.....
Dyckerhoff	do	20.04	3.95	7.48	63.02	1.23	....	1.62	.....
Germania	do	22.54	2.68	7.92	62.36	1.15	....	....	.....
Josson	do	22.92	2.46	7.98	63.39	Trace.	....	1.28	.....
Steel	Slag	30.98	Trace.	14.82	43.00	4.16	....	3.44	.....
Cathedral	Portland composite.	57.76	.98	3.60	34.13	1.04	....	1.00	.....
Silica	do	23.10	.92	4.74	41.77	9.85	....	.66	.....
Akron Star	Natural	20.40	2.56	6.22	40.64	25.80	....	2.91	.....
Austin	do	19.02	1.24	8.96	41.18	26.58	....	1.27	.....
Bonneville Improved.	do	30.40	2.60	10.36	52.12	.21	....	1.24	.....
Hoffman	do	25.00	2.27	8.93	39.30	16.18	4.26	1.40	.....
Mankato	do	27.70	1.86	7.06	37.00	22.63	....	1.23	.....
Newark and Rosendale.	do	28.71	3.60	5.88	27.00	30.00	....	1.30	.....
Norton	do	26,66	3.02	11.48	38.33	16.41	....	1.35	.....
Obelisk	do	23.70	3.30	16.70	37.00	15.30	....	1.98	.....
Potomac	do	32.00	2.70	8.79	33.89	18.10	....	1.31	.....

CHEMICAL ANALYSES OF CEMENT ROCK.

Description.	Silica.	Oxide of iron.	Alumina.	Lime.	Magnesia.	Sulphur trioxide.	Humus and water.
Cement rock, used by Bonneville Portland Cement Co	23.20	2.00	6.52	34.20	1.90	.20	13.63
Limestone, used by Bonneville Portland Cement Co	1.08	.27	....	54.80	.52	....	2.38
Dark cement rock, used by Newark and Rosendale Lime and Cement Co.	22.69	3.28	5.52	20.90	13.75	.96	7.20

FINENESS OF GRINDING.

The fineness of the cements was determined by the usual met sifting and by means of a winnowing device. The sieves em included an ordinary nest of laboratory sieves, fine wire cloth, a bolting cloth; also a special brass wire cloth sieve, electropla reduce the size of the meshes. The number of meshes per squa and their sizes are shown in the following table:

SIEVES.

Description.	Meshes.			
	Number of.	Per square inch.	Size.	
			Maximum.	Minimum.
			Inch.	*Inch.*
ratory nest	a 40	a 1,600	.0162	.0132
	a 60	a 3,600	.0148	.0078
	a 80	a 6,400	.0090	.0057
	a 100	a 10,000	.0079	.0056
s wire	98 x 100	9,800	.0058	0057
	112 x 118	13,216	.0051	.0050
	156 x 170	26,350	.0037	.0034
	188 x 198	37,224	.0031	.0028
ing cloth, No. 20	174 x 182	31,668	.0027	.0025
s wire, electroplated	....	....	b .0020	....

a Nominal. b About.

188 x 198 brass wire cloth and the No. 20 bolting cloth were ommercially rated as No. 200 sieves. The openings in the bolt- oth were smaller than those of the wire sieve, notwithstanding sser number of meshes per square inch, due to the difference in ameter of the wire and the size of the silk threads, modified by anner in which the bolting cloth is woven to maintain meshes of m size throughout the fabric. In order to obtain a finer sieve a wire cloth was electroplated, increasing the size of the wires and ishing the openings. In this manner meshes were obtained which red about ".002 and less in diameter. It was very slow work the plated sieve and the practical limit of fineness is found in the) bolting cloth. Finer material was separated by the use of a wing device in which an air blast was directed against the cement fell from the No. 20 bolting cloth, collecting the material which l in a trough at different distances from the sieve. The sieve was ed to a clapper which was adjusted in front of a toothed wheel, oon rotating the latter a very energetic shaking took place. The ximate sizes of the coarser grains thus sorted, measured by of a microscope, using polished sections of tensile briquettes, ven below:

Grade.	Diameter of grains.	
	Maximum.	Average.
	Inch.	*Inch.*
	.0025	.0013
and A	.0021	.0010
	.0017	.0008
d D	.0013	.0004
	.0008	.0002

er grains were carried down with the coarser parts in each grade, ring ".0001 and less in diameter. The largest part of the win- l material was collected in grades O, ½ A, and A, which comprised r cent of that which passed through the sieve, 6 per cent was in B, less than 2 per cent in grade C, and less than 1 per cent each and E. The separation into different sized grains was generally more efficiently accomplished with the Portlands than with the na cements. With the latter class there was a greater tendency i finer particles to adhere to the coarser grains and to be carried with them.

The relative proportions of grains of different sizes found sifting were as follows:

Brand.	Class.	Size of grain.				
		>.0058	.0050	.0034	.0027	<.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per*
Atlas	Portland	11.2	3.8	9.1	6.6	6
Star	do	12.9	4.7	10.4	11.4	6
Alsen	do	19.3	5.7	7.9	8.2	5
Steel	Slag	2.8			9.1	8
Hoffman	Natural	14.1	1.9	6.4	12.5	6
Mankato	do	33.6			23.8	4
Norton	do	12.5			17.5	7

Chemical analyses were made on sifted and winnowed mat Some earlier analyses showed differences in the composition o grains of different sizes from one brand of cement then exam Subsequently there were 67 complete analyses made on different grains from seven brands, the results of which showed substan the same composition which was found in the material taken fro barrels. In this series of determinations 5 Portland cements used. 1 slag cement, and 1 natural cement.

SPECIFIC GRAVITY.

The specific gravity determinations of loose material were with a Schumann volumeter, in which the displacement of a qua of liquid shows the volume of the cement, benzine being the l used. The specific gravity of hydrated material in the cake was d mined by means of a chemical balance, weighing the material i and in water. Account was taken of the water absorbed whe cement was immersed, thus making the necessary correction for v The results on the loose material taken from the barrels were as fol

Brand.	Class.	Specific gravity.	Remarks.
Alpha	Portland	3.11	
Atlas	do	3.09	
Star	do	3.10	Earlier lot.
	do	3.12	With plaster, 38 days after grindi
	do	3.13	Without plaster, 38 days after grin ing.
Storm King	do	3.07	
Whitehall	do	3.13	14 days after grinding.
Alsen	do	3.08	
Dyckerhoff	do	3.11	
Josson	do	3.04	
Steel	Slag	2.74	
Cathedral	Portland—sand composite.	2.83	
Silica	Portland—limestone composite.	2.87	
Austin	Natural	3.15	
Bonneville Improved	do	2.85	
Hoffman	do	3.06	
Mankato	do	2.93	
Newark and Rosendale	do	3.06	12 days after grinding.
Norton	do	3.03	
Obelisk	do	3.12	
Potomac	do	2.94	

e specific gravity of loose material which was spread out in layers h thick and exposed to the air in a dry, cool storehouse, was found own in the next table.

Brand.	Class.	Specific gravity.	Remarks.
r, with plaster........	Portland	3.09	After 14 days' exposure to the air.
	.....do	3.08	After 28 days' exposure to the air.
r, without plaster	.....do	3.06	After 14 days' exposure to the air.
	.....do	3.04	After 28 days' exposure to the air.
itehall	.....do	3.09	After 14 days' exposure to the air.
	.....do	3.09	After 28 days' exposure to the air.
wark and Rosendale .	Natural	3.03	After 14 days' exposure to the air.
	.....do	3.04	After 28 days' exposure to the air.
rton	.....do	2.82	From a barrel about 10 years' old.
t known	.....do	2.75	Do.

ter heating the material to 110° C. and to redness the results as follows:

SPECIFIC GRAVITY AND LOSS IN WEIGHT UPON HEATING.

Brand.	Specific gravity.			Loss in weight.		Remarks.
	Original condition.	After heating to 110° C.	After heating to redness.	Upon heating to 110° C.	Upon heating to redness from 110° C.	
				Per cent.	*Per cent.*	
r, with plaster ..	3.12	3.13	3.15	0.14	0.61	Fresh material from barrel.
	3.09	3.09	3.18	0.19	2.11	Exposed to air 14 days.
	3.08	3.07	3.16	0.52	2.06	Exposed to air 28 days.
r, without plaster.	3.13	3.15	3.17	0.20	0.80	Fresh material from barrel.
	3.06	3.09	3.18	0.22	1.96	Exposed to air 14 days.
	3.04	3.04	3.15	0.45	1.74	Exposed to air 28 days.
itehall	3.13	....	3.15	....	0.59	Fresh material.
	3.09	3.08	3.19	0.30	1.85	Exposed to air 14 days.
	....	3.09	3.23	....	2.25	Exposed to air 28 days.
thedral	2.83	2.84	2.91	0.15	2.53	From barrel.
ica	2.87	2.89	3.00	0.13	22.24	Do.
wark and Rosendale.	3.06	....	3.16	0.	4.58	Do.
	3.03	3.04	3.15	.20	6.86	Exposed to air 14 days.
	....	3.04	3.14	....	7.20	Exposed to air 28 days.
rton	2.82	....	3.03	....	[a] 9.10	About 10 years old.
known	2.75	....	3.07	....	[a] 10.60	Do.

[a] Total loss in heating from atmospheric temperature.

om the above it appears that drying at 110° C. does not materially ge the specific gravity of the material, but heating to redness res the cement to its primitive value as it came from the barrel, ised it above the value found in the first determination. The s in weight upon heating are shown in the above table, and it will een that the most marked changes in specific gravity are accomed by corresponding losses in weight. The large loss in weight heating the Silica cement to redness is attributed to the presence rushed limestone, which the manufacturers state formed 60 per of this product.

eterminations were made on material which had been mixed with r, set different intervals in air or in water, and reground to pass a No. 40 sieve. The following table shows results of this kind, in ing also a statement of the losses in weights:

SPECIFIC GRAVITY DETERMINATIONS ON MATERIAL WHICH HAD BEEN MIXED WATER AND THEN REGROUND.

Brand.	Specific gravity. Original condition.	Specific gravity. After heating to 110° C.	Specific gravity. After heating to redness.	Loss in weight. Upon heating to 110° C.	Loss in weight. Upon heating to redness from 110° C.	Remarks.
				Per cent.	*Per cent.*	
Star, with plaster..	....	2.47	3.21	10.21	11.10	Set 1 day in air, 6 d in water.
	....	2.57	3.17	6.76	8.43	Set 7 days in air.
	....	2.34	3.14	9.20	11.92	Set 28 days in wat
	....	2.59	3.14	4.92	8.14	Set 28 days in air.
Star, without plaster.	....	2.40	3.17	14.33	12.35	Set 1 day in air, 6 d in water.
	....	2.58	3.18	7.89	9.65	Set 7 days in air.
	....	2.27	3.14	12.83	13.20	Set 28 days in wat
	....	2.56	3.14	4.52	10.60	Set 28 days in air.
Whitehall	....	2.47	3.20	....	11.38	Set 7 days in wate
	....	2.68	3.22	4.68	8.40	Set 9 days in air.
	....	2.38	3.23	....	13.45	Set 28 days in wat
	....	2.63	3.23	....	8.90	Set 28 days in air.
	2.55	2.62	3.21	8.71	8.47	Set 24 hours in air
	2.35	2.36	3.18	9.10	11.34	4 hours retarded.
	2.25	2.27	3.21	12.57	14.79	24 hours retarded. Regro and tempe
	2.27	2.29	3.20	12.32	15.53	146 hours retarded.
Newark and Rosendale.	....	2.80	3.21	....	10.65	Set 7 days in wate
	....	2.87	3.16	2.53	10.21	Set 7 days in air.
	....	2.65	3.14	....	15.01	Set 28 days in wat
	....	2.86	3.18	....	11.35	Set 28 days in air.

The number of hours retarded in the column of remarks op the last three samples of Whitehall cement refers to the inter time after first mixing with water before the material was pu cubical molds. The cement was reground and retempered with in the last two. When 30 days old compression tests were ma the cubes, fragments of which were again ground and the deter tions as above followed on specific gravity and losses in weight heating.

Results on reground material from tensile briquettes, those set in air and those which set in water, are found in the tables come next, to which is added a table showing the comparative thus obtained.

ECIFIC GRAVITY DETERMINATIONS ON REGROUND MATERIAL FROM TENSILE BRIQUETTES, WHICH WERE SET IN AIR.

Brand.	Specific gravity.			Loss in weight.		Remarks.
	Original condition.	After heating to 110° C.	After heating to redness.	Upon heating to 110° C.	Upon heating to redness, from 110° C.	
				Per cent.	*Per cent.*	
pha	2.67	2.70	3.11	3.8	6.9	
as	2.66	2.68	3.17	4.4	6.9	
r	2.61	2.71	3.14	3.8	7.3	
rm King	2.78	2.87	3.15	2.8	6.5	
en	2.60	2.63	3.10	4.0	7.7	
ckerhoff	2.72	2.75	3.18	2.9	6.5	
el	2.42	2.51	2.98	2.9	6.7	
nneville Improved	2.60	2.61	3.05	2.6	13.0	
ffman	2.75	2.77	3.13	5.8	4.5	
rton	2.69	2.80	3.11	2.1	9.6	

ECIFIC GRAVITY DETERMINATIONS ON REGROUND MATERIAL FROM TENSILE BRIQUETTES, WHICH WERE SET IN WATER.

Brand.	Specific gravity.			Loss in weight.		Remarks.
	Original condition.	After heating to 110° C.	After heating to redness.	Upon heating to 110° C.	Upon heating to redness, from 110° C.	
				Per cent.	*Per cent.*	
pha	2.52	2.72	3.09	5.5	8.2	
as	2.55	2.64	3.06	6.5	5.9	
r	2.58	2.63	3.09	4.8	8.0	
rm King	2.69	2.80	3.17	3.1	7.8	
en	2.49	2.54	3.06	4.9	8.9	
ckerhoff	2.68	2.72	3.14	4.0	6.9	
el	2.40	2.47	2.94	5.1	7.4	
nneville Improved	2.60	2.65	3.00	3.5	12.0	
ffman	2.62	2.66	3.10	3.3	11.8	
rton	2.58	2.73	3.13	3.8	11.8	

ARISON OF SPECIFIC GRAVITY DETERMINATIONS ON REGROUND MATERIAL FROM TENSILE BRIQUETTES, SET IN AIR AND SET IN WATER.

Brand.	Specific gravity.		Excess of specimen set in air.	Specific gravity, original material from barrel.
	Set in air.	Set in water.		
pha	2.67	2.52	0.15	3.11
las	2.66	2.55	.11	3.09
ar	2.61	2.58	.03	3.10
orm King	2.78	2.69	.09	3.07
sen	2.60	2.49	.11	3.08
ckerhoff	2.72	2.68	.04	3.11
eel	2.42	2.40	.02	2.74
nneville Improved	2.60	2.60	0.	2.85
offman	2.75	2.62	.13	3.06
orton	2.69	2.58	.09	3.03
elisk	2.75	2.76	—.01	3.12
Means of determinations	2.66	2.59	.07	3.03

In the table which next follows the material on which th
tions were made was taken from a series of tests on the
exposure to different temperatures while setting. The
set at the temperatures tabulated at 36° F. and 0° F. we
cold-storage warehouse during the period of three mon
intervening between the mixing with water and when the
tested. The specific gravity determinations followed se
tests for strength were completed.

SPECIFIC GRAVITY DETERMINATIONS ON REGROUND MATERIAL FROM
AIR, WHICH WERE EXPOSED TO DIFFERENT TEMPERATURES WHII

[Dried at 110° C. before making the determinations.]

Brand.	Temperatur	
	70° F.	3
Star	2.76	
Storm King	2.83	
Alsen	2.75	
Josson	2.70	
Steel	2.48	...
Austin	2.95	
Bonneville Improved	2.65	
Hoffman	2.87	
Norton	2.87	
Obelisk	2.89	

The above material after heating to redness gave the
appear in the following table:

Brand.	Specific gravity after heating to redness. Material from cubes set in air at temperatures of—			Loss in weig redness fr terial set i atures of—	
	70° F.	36° F.	0° F.	70° F.	3
Star	3.21	3.22	3.18	8.68	
Storm King	3.14	3.15	3.17	8.50	
Alsen	3.21	3.19	3.18	9.96	
Josson	3.20	3.16	3.18	8.96	
Steel	2.98	....	2.92	10.03	...
Austin	3.25	3.23	3.26	7.84	
Bonneville Improved	3.07	3.04	3.08	16.10	
Hoffman	3.26	3.17	3.22	11.04	
Norton	3.17	3.14	3.17	10.00	
Obelisk	3.18	3.22	3.22	8.08	
Means, omitting the Steel cement	3.19	3.17	3.18	9.91	

eterminations of the carbon dioxide driven off and water, taken ifference, upon heating this material to redness from 110° C. gave ollowing results:

Brand.	Loss on heating to redness. Material set in air at temperatures of—								
	70° F.			36° F.			0° F.		
	Total.	H_2O.	CO_2.	Total.	H_2O.	CO_2.	Total.	H_2O.	CO_2.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
ar	8.68	1.68	7.00	9.92	5.02	4.90	7.12	3.52	3.60
sen	9.96	3.23	6.73	11.48	7.68	3.80	7.08	3.88	3.20
sson	8.96	2.66	6.30	10.56	5.96	4.60	5.38	2.55	2.83
eel	10.03	3.94	6.09	....	....	....	7.92	4.82	3.10
stin	7.84	1.76	6.08	10.12	4.12	6.00	4.92	1.92	3.00
onneville Improved	16.10	4.12	11.98	15.96	5.96	10.00	13.60	6.70	6.90
offman	11.04	3.04	8.00	11.40	3.40	8.00	9.12	5.35	3.77
orton	10.00	2.16	7.84	12.36	4.86	8.00	9.08	5.18	3.90
elisk	8.08	2.48	5.60	8.96	3.36	5.60	5.92	3.32	2.60
Means, omitting the Steel cement	10.08	2.64	7.44	11.35	4.98	6.36	7.78	4.05	3.73

e original amount of water, by weight, used in mixing the above rial and the ages of the samples when heated were as follows:

Brand.	Material set in air at temperatures of—					
	70° F.		36° F.		0° F.	
	Water.	Age.	Water.	Age.	Water.	Age.
	Per cent.	*Days.*	*Per cent.*	*Days.*	*Per cent.*	*Days.*
ar	23.4	60	25.7	78	23.4	60
sen	28.2	43	28.2	43	28.2	63
sson	26.0	42	26.0	42	27.3	56
eel	34.4	41	....	....	36.2	56
stin	37.1	57	37.1	57	36.7	63
onneville Improved	35.9	44	35.9	44	38.6	62
offman	35.5	58	35.5	58	35.7	55
orton	37.9	46	38.2	79	38.0	81
elisk	36.2	53	36.2	53	38.6	62

eterminations made on several brands in which different percent- of water were used, ranging from 5 to 40 per cent by weight, are d in the next table. The results show that a small quantity of r is adequate to bring about a decided reduction in specific gravity, ing a reduction not greatly modified when larger quantities of r were used.

SPECIFIC GRAVITY DETERMINATIONS ON REGROUND MATERIAL, 3 DAYS A MIXING WITH DIFFERENT PERCENTAGES OF WATER.

[Dried at 110° C. before making determinations.]

Brand.	Specific gravity. Material mixed with percenta water of—				
	5 per cent.	10 per cent.	15 per cent.	20 per cent.	30 per cent.
Alpha	....	....	2.69	....	2.59
Dyckerhoff	2.94	2.88	2.82	....	2.73
Steel	....	....	2.56	....	2.47
Bonneville Improved	2.69	2.73	2.73	2.75	....
Mankato	2.83	2.80	2.77	2.77	....

Determinations were made on the coarser and finer parts of th cement, using material taken from the barrel which was gra sifting, repeating the determinations on the same grades after to redness. The results given below show in the two Portland c lowest values in specific gravity for the grains finer than ".002 eter in the original condition as taken from the barrel. In the cement examined a difference is seen between the grains coars ".0058 diameter and the finer parts. After heating, these diff are less, while each grade displays a higher value. A more c uous feature is the relative loss in weight of the different samp is seen that the loss with the finer material is twice or more tin of the grains ".0027 diameter and coarser.

SPECIFIC GRAVITY DETERMINATIONS ON MATERIAL OF DIFFERENT SIZED G ORIGINAL CONDITION AND AFTER HEATING TO REDNESS.

Brand.	Size of grain.	Specific gravity.		Loss in weight on heating to redness.	Rema
		Original condition.	After heating to redness.		
	Inch.			*Per cent.*	
Star	>.0058	3.09	3.10	0.9	
	.0050	....	3.14	1.0	
	.0034	3.12	3.15	0.9	
	.0027	3.12	3.15	1.0	
	<.0027	3.04	3.10	2.0	
Alsen	>.0058	3.07	3.11	0.7	
	.0050	3.12	3.14	0.7	
	.0034	3.08	3.15	0.7	
	.0027	3.09	3.14	0.8	
	<.0027	2.99	3.12	2.2	
Hoffman	>.0058	3.08	....	1.1	
	.0027	3.00	....	1.4	
	<.0027	3.02	....	2.8	

Material of different sized grains of the grades shown in table was mixed with water and the specific gravity determi minutes after mixing, and later after having been mixed 5 da was then heated to redness, the loss in weight ascertained, and gravity again determined. The material from two of the bran again mixed with water and its specific gravity determined later. These results agree with the examination of the loose m of the preceding table in respect to the greater changes in the for the finer parts of the cements in the case of the Portlands. With the natural cement in the hydrated state the coarse grains showed the lowest specific gravity in two determinations. The tendency of the coarse grains of this class of cement to retain considerable of the finer material on their surface prevented the more complete grading which was accomplished with the Portlands.

SPECIFIC GRAVITY DETERMINATIONS ON MATERIAL OF DIFFERENT SIZED GRAINS IN THE ORIGINAL CONDITION FROM THE BARREL, GRADED BY SIFTING, AND ON REGROUND MATERIAL AFTER MIXING WITH WATER.

[Reground material was dried off at 110° C. before making the determinations.]

Brand.	Size of grain.	Specific gravity.				Loss in weight on heating to redness from 110° C.	Specific gravity after remixed 5 days additional.
		Original condition.	Mixed 30 minutes.	Mixed 5 days.	After heating to redness.		
	Inch.					*Per cent.*	
Star	>.0058	3.09	3.04	2.94	3.09	5.0	2.88
	.0050	....	3.04	2.94	3.14	6.0	2.87
	.0034	3.12	3.10	2.90	3.11	6.4	2.82
	.0027	3.12	3.06	2.89	3.09	6.4	2.79
	<.0027	3.04	2.72	2.68	3.04	13.0	2.61
Alsen	>.0058	3.07	3.02	2.92	3.09	3.0	....
	.0050	3.12	3.08	2.97	3.05	2.8	....
	.0034	3.08	3.05	2.93	3.00	3.2	....
	.0027	3.09	3.05	2.89	3.09	3.8	....
	<.0027	2.99	2.83	2.37	2.99	11.8	....
Hoffman	>.0058	3.08	2.73	2.75	3.10	9.0	2.62
	.0027	3.00	2.96	2.92	3.17	8.9	2.67
	<.0027	3.02	2.86	2.82	3.12	9.8	2.64

The incompleteness of the change in specific gravity in the early stages after mixing, shown in the preceding table, is further illustrated in the following tests made with different sifted grades of another cement, which was treated by heating in water, at the temperature of 100° C. for periods of 1, 6, and 24 hours, then dried to a constant weight of 110° C., and the specific gravity determinations then made:

Brand.	Size of grain.	Specific gravity.			
		Before hydration.	After heating in water—		
			1 hour.	6 hours.	24 hours.
Whitehall	From the barrel	3.12	....	....	....
	>.0058 inch	3.15	3.01	2.91	2.83
	.0027 to .0058 inch	3.07	2.81	2.44	2.35
	<.0027 inch	3.14	3.07	2.84	2.55

There were determinations on the reground material of some tensile briquettes, made from cement graded by the winnowing device. These briquettes were set in air and tested when 34 or 35 days old. An additional period of 2 years 9 months elapsed after the time of the tensile tests, during which interval the fractured ends remained in air.

MATERIAL FROM TENSILE BRIQUETTES OF DIFFERENT GRADES OF FINENESS, WHICH SET IN AIR 2 YEARS 10 MONTHS.

Brand.	Grade.	Water used in the briquettes.	Tensile strength when 34 or 35 days old.	Specific gravity.			Loss in weight on heating—			
				Original.	After heating to 110° C.	After heating to redness.	To 110° C.	From 110° C. to redness.		
								Total.	H_2O.	CO_2.
		Per cent.	*Lbs. per sq. inch.*				*Per ct.*			
Atlas.....	A	30	360	2.55	2.59	3.23	3.42	16.77	4.56	12.21
	B	30	242	2.58	2.60	3.23	3.35	16.86	4.00	12.86
	C	30	242	2.52	2.57	3.19	3.59	17.63	4.83	12.80
	D	30	221	2.52	2.56	3.24	3.96	16.44	5.24	11.20
	A	25	405	2.60	2.60	3.19	3.05	15.25	5.44	9.81
	B	25	312	2.59	2.61	3.23	3.27	15.36	4.60	10.76
	C	25	298	2.59	2.60	3.25	3.12	15.82	5.62	10.20
	A	20	537	2.63	2.66	3.25	2.92	13.50	4.33	9.17
	B	20	352	2.63	2.69	3.22	2.98	13.60	4.02	9.58

The four determinations which are next given were from briquettes made of different sifted grades of a Portland cement. The briquettes were tested when 7 days old, developing at the time the tensile strengths shown in the table below, after which the fractured ends were placed in a case of drawers, where they have remained a period of two and one-half years. These and other samples of the same series in which the coarser grains of the cement were used have reached a state of partial or complete disintegration, two of the samples here reported upon having lost their identity, excepting they are known to have contained in their fabrication the coarser grains of the sifted material.

Description.	Tensile strength age 7 days.	Specific gravity after heating—		Loss in weight after heating—			
		To 110° C.	To redness	To 110° C.	From 110° C. to redness.		
					Total.	H_2O.	CO_2.
	Lbs. per sq. inch.			*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Débris of unidentified briquette............		3.03	3.19	0.59	3.84	1.99	1.85
		2.99	3.19	.57	4.69	1.42	3.27
Débris of a briquette made of cement grains ″.0034 diameter, 18 per cent of water used	183	2.94	3.19	.98	6.42	1.76	4.66
From a partially disintegrated briquette made of equal parts of winnowed material grade A, and cement grains ″.0050 diameter, 15 per cent of water used.........	123	2.91	3.14	1.25	7.89	2.23	5.64

Other fragments were retained from tensile briquettes of the same brand of cement as above, in which neat, unsifted material from the barrel was used, and also fragments from briquettes made of mortars composed of the material from the barrel with sand or granite dust in different proportions, and these still remain intact with hardness due to their interval of aging apparently normal.

Material from the outside and inside portions of a 2″ cube, mixed with 25.8 per cent water, and set in the air eight months, gave the following results on the reground cement in the original condition from the cube and the same after heating to 110° C. and to redness:

Brand.	Description.	Specific gravity.			Loss in weight after heating—	
		Original condition.	After heating to 110° C.	After heating to redness.	To 110° C.	From 110° C. to redness.
					Per cent.	*Per cent.*
Storm King..	Material taken within ″.10 from the surface of the cube.	2.68	2.70	3.17	3.65	14.57
	Material taken below ″.25 from the surface of the cube.	2.68	2.74	3.19	4.87	8.22

A fresh fracture of the above cube when treated with hydrochloric acid effervesced in that part which lay near the original surface. This behavior was restricted to a zone not exceeding ″.10 in depth. There was a further examination of the same material when 11 months old, and determinations on reground sifted material of different-sized grains, also on material from a thin slab, measuring $\frac{3}{16}$″ thick by 2″ wide by 6″ long, which set in air nineteen weeks and was found to contain 8.60 per cent of carbon dioxide.

Brand.	Description.	Specific gravity.			Loss in weight after heating—	
		Original condition.	After heating to 110° C.	After heating from 110° C. to redness.	To 110° C.	From 110° C. to redness.
					Per cent.	*Per cent.*
Storm King..	Material taken from the inside portions of 2″ cubes.	2.71	2.79	3.23	6.54	7.67
	Grains ″.0058 to ″.016 diameter.	2.73	....	....	....	....
	Grains ″.0027 to ″.0058 diameter.	2.77	....	....	....	....
	Grains <″.0027 diameter	2.70	....	....	....	....
Star..........	Material from slab $\frac{3}{16}$″ x 2″ x 6″.	2.72	2.80	3.19	2.24	11.46

The specific gravities of cements which were treated in considerable quantities of water, hot and cold, appear in the next table. The cement was stirred at frequent intervals to prevent caking in the water. The temperature of the cold-water bath was the temperature of the room. The hot-water bath was about 95° C. After treatment and drying in the air the cement was broken up and reground, then dried at 110° C. and specific gravities determined.

Brand.	Class.	Condition of water.	Specific gravity, after treatment in water for periods of—				
			Half hour.	16 hours.	25 hours.	2 days.	5 days.
Alpha	Portland	Hot	2.94	2.61	2.58	2.50	2.45
	do	Cold	2.97	2.81	2.72	2.56	2.49
Dyckerhoff	do	Hot	3.03	2.96	2.79	2.76	2.66
	do	Cold	3.08	2.95	2.87	2.84	2.69
Steel	Slag	Hot	2.64	2.61	2.57	2.57	2.58
	do	Cold	2.66	2.62	2.59	2.55	2.53
Bonneville Improved	Natural	Hot	2.72	2.71	2.70	2.68	2.65
	do	Cold	2.83	2.80	2.78	2.69	2.66
Hoffman	do	Hot	2.94	2.86	2.80	2.72	2.6[illegible]
	do	Cold	3.02	2.98	2.97	2.96	2.9[illegible]
Mankato	do	Hot	2.80	2.71	2.61	2.50	2.39
	do	Cold	2.84	2.85	2.84	2.84	2.84

The results heretofore given refer to the loose material, either in the condition as taken from the original packages or hydrated material reground to a fine powder.

The results which follow show specific gravities of the material in the cake after mixing with water and molding into cubes or briquettes. These determinations were made by means of a chemical balance, weighing the material in air and in water. In order to make the necessary correction for water absorbed when immersed, the specific gravity was computed by dividing the dry weight of the material in air by the difference of its wet weight in air and weight when in water. The material was immersed in water four days before taking its wet weight in air and weight in water.

The following table shows the specific gravity of halves of tensile briquettes, from samples which set in air and from those which set in water:

MATERIAL IN THE CAKE.

Brand.	Class.	Specific gravity, briquettes which set in—	
		Air.	Water.
Alpha	Portland	2.23	2.29
Dyckerhoff	do	2.11	2.07
Steel	Slag	1.74	1.79
Bonneville Improved	Natural	1.65	1.66
Hoffman	do	1.79	1.77
Mankato	do	1.65	1.66
Atlas (material from 12″ cubes)	Portland	....	1.92 to 2.17

In the following table are the results on material in the cake, set in air, which was exposed to different temperatures while setting. One-quarter of a 2″ cube was used in each determination.

Brand.	Specific gravity and marks of identification, cubes which set in air at temperatures of—					
	70° F.		36° F.		0° F.	
	Specific gravity.	Marks.	Specific gravity.	Marks.	Specific gravity.	Marks.
Star	2.181	Feb. 8	2.233	Jan. 22	2.190	Feb. 8
Storm King	1.961	Feb. 4	2.084	Jan. 24	2.224	Jan. 28
Alsen	1.978	Feb. 19	2.093	Feb. 19	2.036	Feb. 6
Josson	1.932	Feb. 20	2.138	Feb. 20	2.012	Feb. 15
Steel	1.705	Feb. 21	1.797	Feb. 21	1.749	Feb. 13
Austin	1.869	Feb. 12	1.832	Feb. 12	1.940	Feb. 6
Bonneville Improved	1.605	Feb. 18	1.793	Feb. 18	1.820	Feb. 7
Hoffman	1.618	Feb. 11	1.938	Jan. 25	1.908	Feb. 11
Norton	1.579	Feb. 23	1.790	Jan. 21	1.911	Jan. 19
Obelisk	1.659	Feb. 16	1.931	Feb. 16	1.884	Feb. 7

The marks indicate the dates on which the cubes were made. Those of the same brand and date came from the same batch of mixed material.

The results which next follow were obtained on material in the cake as described for the last table, but drying each sample before determining its specific gravity by heating for three hours at the temperature of 110° C.

Brand.	Specific gravity and marks of identification, cubes which set in air at temperatures of—			
	70° F.		0° F.	
	Specific gravity.	Marks.	Specific gravity.	Marks.
Star	2.071	Feb. 8	2.003	Feb. 8
Storm King	1.953	Feb. 4	1.912	Jan. 28
Alsen	1.887	Feb. 19	1.875	Feb. 6
Josson	1.910	Feb. 20	1.750	Feb. 13
Steel	1.564	Feb. 21	1.380	Feb. 13
Austin	1.564	Feb. 12	1.538	Feb. 12
Bonneville Improved	1.577	Feb. 18	1.466	Feb. 7
Hoffman	1.606	Feb. 11	1.505	Feb. 11
Norton	1.558	Feb. 23	1.512	Jan. 19
Obelisk	1.653	Feb. 16	1.483	Feb. 7

In the next table are shown results obtained upon material in the cake which was mixed with large quantities of water. The inner portions of 2″ and 4″ cubes furnished the samples on which the determinations were made. These grout mixtures were allowed to remain in the mixing bed different periods of time until the water was absorbed by the cement and a pasty state acquired, when the material was placed in the molds. The column headed "Hours retarded" states the interval between the time of mixing and when the material was put into the molds. The specific gravity determinations were made when the cubes were from 4 to 6 weeks old, the material having set in air during the interim.

Brand.	Water.		Hours retarded.	Specific gravity.
	Per cent.	Temperature.		
		°F.		
Star, without plaster	40	65	4¼	1.901
	50	65	7¼	1.765
	60	65	15	1.641
	70	65	30¼	1.501
	80	65	44	1.490
Star, with plaster	40	65	6¼	1.560
	60	65	11	1.522
	80	65	34	1.479
	100	65	45	1.276
Star, without plaster	40	33	None.	1.875
	50	33	None.	1.755
	60	33	None.	1.493
Star, without plaster[a]	64.7	33	3	1.473
	71.1	33	4	1.462
	50	180	2¼	1.606

[a] These three mixtures were put into the molds while still thin grouts, the pasty state not having been acquired by them.

The specific gravity of the cement rock used by the Bonneville Portland Cement Company in the state of the solid rock was 2.71. After grinding and sifting to a size $<''.0027$ diameter of grain, the value found was 2.69. The ground material was burnt at a temperature of about 1,400° C. (2,550° F.), after which the specific gravity of the loose powder was 2.98.

The specific gravity of the limestone used by the above cement company in the state of the solid rock was	2.70
After grinding to powder and sifting	2.70
Fragments of the stone were burnt to the state of quicklime, ground and sifted, the specific gravity of which was	3.30
The same after hydration and drying at 110° C. was	2.30
Heating the slaked lime to redness, the specific gravity was restored to	3.3
The observed loss in weight on the last heating was ... per cent	25.7

DETERMINATION OF WATER AND CARBON DIOXIDE IN CEMENT AFTER HYDRATION.

These determinations were carried along jointly with the specific gravity determinations, and some of the results have been incorporated in the preceding tables.

Brand.	Description.	Loss in heating from 110° C. to redness.		
		Total.	H_2O.	CO_2.
		Per cent.	*Per cent.*	*Per cent.*
Lehigh	Fresh from barrel			1.05
Whitehall	do	.65	.55	.10
	Exposed to the air 14 days	1.64	.90	.74
	Reground material from briquette set in air 28 days.	8.90	7.30	1.60
	Reground material from briquette set in water 28 days.	13.45	10.31	3.14
	Reground material from briquette set in water 7 days.	11.26	10.00	1.26
	Reground material from a 6″ cube, 4 hours retarded, set in air 36 days.	11.34	7.22	4.12

Brand.	Description.	Loss in heating from 110° C. to redness.		
		Total.	H_2O.	CO_2.
		Per cent.	*Per cent.*	*Per cent.*
Whitehall	Reground material from a 4″ cube, set in air 24 hours, reground and retempered, set in air 35 days.	14.79	10.37	4.42
Cathedral	Fresh from barrel	2.51	1.09	1.42
Silica	.....do	22.24	3.24	19.00
Newark and Rosendale.	.....do	4.74	1.22	3.52
	Exposed to the air 28 days	7.20	2.06	5.14
	Reground material from a briquette set in air 28 days.	11.26	4.46	6.80
	Reground material from a briquette set in water 28 days.	15.10	9.34	5.76
Storm King	Material from a 2″ cube set in air 8 months, taken within ″.10 from the surface.	14.57	5.88	8.69
	From same cube as above, taken below ″.25 from the surface.	8.22	5.62	2.60

The material used in the determinations given in the next table was taken from a series on retarded sets, in which the cement was agitated at 2-hour intervals, and put into the molds at the times stated in the column headed "Hours retarded." The original quantity of water used in the mixing was 28.6 per cent, more water being added at intervals. Four-inch cubes were made and set in air 35 days. The material was then reground and the determinations made.

Brand.	Hours retarded.	Loss in heating—			
		To 110° C.	From 110° C. to redness.		
			Total.	H_2O.	CO_2.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Whitehall	8	7.40	13.77	11.90	1.87
	12	9.96	15.02	11.37	3.65
	16	10.08	16.64	13.22	3.42
	20	11.04	17.18	13.48	3.70
	24	12.80	16.51	13.17	3.34
	30	14.48	17.49	13.79	3.70
	36	15.36	16.77	13.42	3.35
	40	16.00	17.70	14.70	3.00
	48	15.52	....	....	....
	56	16.92	....	....	....
	64	14.08	....	....	....

Additional determinations on loose material from the barrels were made about seven months subsequent to the determinations shown in preceding tables, with the following results:

Brand.	Loss on heating from atmospheric temperatures to redness.		
	Total.	H_2O.	CO_2.
	Per cent.	*Per cent.*	*Per cent.*
Star, with plaster	1.37	1.12	0.25
Whitehall	1.27	.99	.28
Austin	4.36	1.46	2.90
Hoffman	5.14	.56	4.58
Newark and Rosendale	7.36	.17	7.19

Some thin slabs, measuring $\frac{3}{16}''$ thickness, 2″ wide, and 6″ long, were prepared and set in air, having special reference to a determination of the absorption of carbon dioxide. Twenty-five per cent of water was used on the mixing. Determinations were made with the material at different ages.

Brand.	Age of sample.	Loss on heating from atmospheric temperature to redness.		
		Total.	H_2O.	CO_2.
		Per cent.	*Per cent.*	*Per cent.*
Star, with plaster	1 day	....	....	1.90
	2 weeks	....	....	2.60
	4 weeks	....	....	3.62
	19 weeks	....	....	6.60

The following determinations were made for the purpose of ascertaining the amount of carbon dioxide absorbed by the reground hydrated cement while drying in the open air at 110° C. This material was taken from the inside portions of 2″ cubes which were set in air. Two samples were taken from each of two brands of cement. The first was brought at once to a red heat from atmospheric temperature: the second was dried at 110° C., and then heated to redness. In this comparison the percentages are based upon the weight of the cements after drying at 110° C.

Brand.	Age of cube.	Loss on heating from atmospheric temperature to redness.		
		Total.	H_2O.	CO_2.
	Months.	*Per cent.*	*Per cent.*	*Per cent.*
Star	3	12.22	11.36	0.86
Storm King	11	13.70	9.42	4.28

Drying the material at 110° C. from the atmosphere, the losses in weights were:

Star..............3.78 per cent
Storm King......5.78 per cent

and then heating to redness the losses were:

Brand.	Age of cube.	Loss on heating from 110° C. to redness.		
		Total.	H_2O.	CO_2.
	Months.	*Per cent.*	*Per cent.*	*Per cent.*
Star	3	9.95	8.33	1.62
Storm King	11	8.70	3.60	5.10

The differences in the carbon dioxide of the two sets of determinations are seen to be, for the Star......................0.76 per cent and for the Storm King...........................0.82 per cent

If the carbon dioxide displaces a certain amount of water in the conversion of the hydrate to the carbonate of lime, as represented in the equation—

$$Ca(OH)_2+CO_2=CaCO_3+H_2O$$

the equivalents in water for the differences above shown become 0.31 per cent for the Star, and 0.33 per cent for the Storm King.

Determinations were made on the changes in weight during aging, and upon the subsequent heating of a cake of cement, which was set in the air 36 days. Fifty grams of Whitehall cement were used mixed with 15 grams of water—that is, 30 per cent of the cement by weight, or in the mixture the percentage of water becomes 23.1 per cent. At the end of the above period of time the cake was ground to pass a No. 40 sieve, and the determinations then made. The following table shows the changes in weight during aging:

Age.	Weight.	Loss in weight.		Age.	Weight.	Loss in weight.	
		Total.	Successive.			Total.	Successive.
Days.	*Grams.*	*Grams.*	*Grams.*	*Days.*	*Grams.*	*Grams.*	*Grams.*
0	65.000	0.	0.	12	57.996	7.004	.065
1	62.560	2.440	2.440	14	57.786	7.214	.210
3	59.850	5.150	2.710	17	57.576	7.424	.210
5	59.070	5.930	.780	20	57.524	7.476	.052
6	58.859	6.141	.211	24	57.403	7.597	.121
8	58.220	6.780	.639	33	57.319	7.681	.084
10	58.061	6.939	.159	36	57.207	7.793	.112

The loss in weight of the mixture during aging is shown to be 11.99 per cent. Of the above material 30 grams were heated from atmospheric temperature to redness, showing a loss in weight of 3.836 grams = 12.79 per cent. Using about a gram in weight of the same material, a determination showed the total loss on heating to redness as before, 12.81 per cent, of which 9.89 per cent was water and 2.92 per cent carbon dioxide.

THE TIME OF SETTING.

The interval of time during which the cement is said to set was determined according to two methods, the Gillmore method and a German method. According to the former, two periods are noted, initial set, when the cement pat will sustain a needle $\frac{1}{12}''$ diameter, loaded to weigh $\frac{1}{4}$ pound, thus giving a pressure of 46 pounds per square inch, and the time of final set, when it will sustain a needle $\frac{1}{24}''$ diameter, loaded to weigh 1 pound = 733 pounds per square inch, each without indentation.

In the latter method a needle ".0444 diameter is employed, loaded to weigh .662 pounds, thus giving a pressure of 427 pounds per square inch, which is used with a pat about 3".15 diameter by 1".575 deep. "The moment at which the needle is no longer capable of completely penetrating the cement pat is considered the beginning of the time of setting. The time intervening between this and the moment when the needle no longer leaves an appreciable impression on the hardened pat is considered the time of setting."

The results obtained according to these two methods are shown on the diagrams which follow. Different percentages of water were used in the mixtures as indicated, and the modifying effects are seen in the results. Differences in manipulation may also modify the apparent time of setting in the case of the drier mixtures, vigorous tamping causing water to flush on the upper surface at the expense of the lower part of the pat, thereby tending to increase the interval of initial set by the one method, and shortened the corresponding interval of the other. Small circles are used on the diagrams to define the initial and final periods of a test, connected by full lines representing the duration. When only the initial phase was determined a dotted line is drawn from the circle which indicates the beginning of the change.

TIME OF SETTING OF CEMENTS.

Brand of cement.	Water.	Time of setting.						Remarks.
		Gillmore's method.			German method.			
		Initial.	Final.	Interval.	Initial.	Final.	Interval.	
	Per ct.	*Hrs. mins.*	*Hrs. mins.*	*Hrs. mins.*	*Hrs. mins.*	*Hrs. mins.*	*Hrs. mins.*	
Alpha	20	2 20	5 00	2 40	0 35	4 25	3 50	
	25	3 20	7 30	4 10	2 50	6 35	3 45	
	30	5 40	....	....	4 40	8 40	4 00	
Atlas	20	4 05	7 10	3 05	2 45	6 10	3 25	
	25	5 10	8 05	2 55	3 35	7 05	3 30	
	30	7 00	....	....	5 30	....	....	
Star, with plaster.	20	2 10	4 25	2 15	0 50	3 00	2 10	Age, 42 days.
	25	4 35	6 00	1 25	3 00	5 30	2 30	
	30	5 45	....	....	5 10	7 15	2 05	
Star, without plaster.	20	0 05	0 15	0 10	0 05	0 10	0 05	Do.
	25	0 35	4 55	4 20	0 10	3 30	3 20	
	30	5 10	8 35	3 25	3 15	6 50	3 35	
Whitehall	20	1 49	5 19	3 30	1 28	4 44	3 16	Age, 22 days.
	25	4 15	6 05	1 50	3 25	5 40	2 15	
	30	4 59	7 19	2 20	4 33	6 58	2 20	
Josson	20	0 30	4 35	4 05	0 05	3 40	3 35	
	25	4 10	6 40	2 30	3 10	6 10	3 00	
	30	5 35	8 05	2 30	4 50	7 20	2 30	
Storm King	25	4 02	6 57	2 55	1 42	5 37	3 55	
	28	5 30	....	....	4 20	7 05	2 45	
	30	5 47	....	....	4 27	....	....	
Alsen	25	0 25	1 15	0 50	0 10	0 35	0 25	
	30	0 30	1 15	0 45	0 20	0 45	0 25	
	35	2 30	4 00	1 30	0 30	1 50	1 20	
Silica	20	0 20	2 52	2 32	0 13	0 37	0 24	
	25	0 29	4 59	4 30	0 22	1 49	1 27	
Cathedral	22	4 52	6 17	1 25	1 12	5 32	4 20	
	25	4 45	6 55	2 10	2 40	6 10	3 30	
	28	5 05	7 29	2 24	3 33	6 45	3 12	
Akron Star	30	2 25	6 30	4 05	0 45	4 55	4 10	
	35	4 05	7 10	3 05	2 45	6 35	3 50	
	40	6 55	....	....	6 15	....	....	
Austin	30	0 47	2 51	2 04	0 16	2 08	1 52	
	35	1 03	3 18	2 15	0 43	2 28	1 45	
	40	1 23	4 48	3 25	1 08	3 58	2 50	
Hoffman	30	2 15	3 25	1 10	1 25	2 55	1 30	
	35	2 55	5 40	2 45	2 20	4 10	1 50	
	40	3 43	....	....	2 48	....	....	
Norton	30	0 37	2 12	1 35	0 25	1 00	0 35	
	35	0 49	3 14	2 25	0 34	1 54	1 20	
	40	1 02	5 17	4 15	0 40	3 37	2 57	
Obelisk	30	1 40	4 05	2 25	0 25	3 20	2 55	
	35	2 47	5 02	2 15	1 49	4 12	2 23	
	40	3 15	5 20	2 05	2 50	4 15	1 25	
Potomac	30	0 45	3 40	2 55	0 25	1 55	1 30	
	35	1 05	4 43	3 38	0 43	2 58	2 15	
	40	1 15	5 30	4 15	1 07	4 25	3 18	
Newark and Rosendale.	35	0 37	1 17	0 40	0 32	1 07	0 35	
	40	0 47	3 44	2 57	0 40	2 19	1 39	
	45	1 08	4 18	3 10	0 48	3 33	2 45	
Mankato	40	2 40	5 15	2 35	1 20	3 55	2 35	
	45	2 59	....	....	2 29	4 19	1 50	
	50	3 24	....	....	2 50	5 09	2 19	

TEMPERATURES ACQUIRED BY CEMENTS DURING SETTING

These observations were made upon 12″ cubes, mixed with water and set in plank molds, with upper surfaces exposed to the air. The rise of temperature was observed by means of a stem-graduated thermometer resting in a small, thin, copper tube embedded in the cement, which reached to the center of the cube. A small quantity of oil was used in the bottom of the tube to aid in conducting the heat promptly to the thermometer.

In experiments of this kind the temperature attained depends upon the quantity of the material used. Small cubes show slight changes in temperature. which increases with the size of the cube. Twelve-inch cubes were adopted as a convenient practical limit in these tests.

The highest temperatures were reached by the Portland cements as a class, in some cases exceeding the boiling point of water. A number of hours elapsed before the maximum was attained, generally from 6 to 12 hours with neat Portland cement, while a 1 : 1 mortar required about 18 hours, the latter, however, reaching only 52° C. as a maximum. Some modifications respecting the maximum temperature and the interval of time in reaching it may be effected by using different quantities of water in the mixing.

Cement held in the mixing bed different intervals and then put into the molds shows an increase in temperature, but in a less degree. The diagrams show that the curves of such batches, whether they remained at rest or were kept in a state of agitation in the mixing bed, remained below the same material which was immediately put into the molds.

The natural cements early attained their maximum temperature, but this maximum is much below the Portlands. Cements which reach the highest temperatures show the sharpest crests in their curves. The observations extended over a day and a half, at the end of which time the Portlands still remained above the temperature of the atmosphere; the natural cements, however, had nearly or quite returned to the temperature of the room. The mixing was done when the temperature of the room ranged from 22° to 24° C., but owing to the rapid heating of some cements much higher temperatures were reached by the cubes before the material could be tamped into the molds and the initial reading of the thermometer taken. Mixing with hot water promoted the prompt attainment of higher temperatures. The same brand of cement with and without plaster of paris in its composition showed different temperature curves, the usual composition with plaster reaching the higher temperature.

MAXIMUM TEMPERATURES ATTAINED BY CEMENTS WHILE SETTING.

[Observations made on 12-inch cubes.]

No. of diagram.	Brand.	Class.	Composition.		Per cent of water.	Maximum temperature.	Remarks.
			Cement.	Sand.			
						°C.	
1	Alpha	Portland	Neat		26.2	95.0	
	Star	do	do		26.5	76.0	
	Storm King	do	do		27.0	42.5	
	Steel	Slag	do		35.6	32.0	
2	Whitehall	Portland	do		25.2	103.5	20 days old after grinding.
3	Dyckerhoff	do	do		25.0	63.0	
	do	do	do		27.5	60.5	
	Josson	do	do		29.7	51.0	
4	Alpha	do	do		22.5	102.0	
	do	do	do		26.2	102.5	
	do	do	do		35.0	96.0	
5	Alsen	do	do		29.4	75.0	
	Alsen <″.0058	do	do		36.5	61.0	
6	Alpha	do	do		30.0	99.0	
	do	do	do		26.2	106.0	2 hours retarded.
7	Atlas	do	do		23.6	73.0	2 hours agitated.
	do	do	do		26.0	69.0	5 hours agitated.
	do	do	do		29.0	58.5	8 hours agitated.
8	do	do	do		22.7	81.5	
	do	do	do		24.8	72.0	2 hours' rest.
	do	do	do		32.0	68.5	5 hours' rest.
	do	do	do		38.8	57.0	8 hours' rest.
9	Bonneville Improved.	Natural	do		37.6	39.5	
	Obelisk	do	do		35.0	37.5	
	Hoffman	do	do		36.5	34.0	
10	Austin	do	do		40.0	35.0	
	Mankato	do	do		44.6	40.0	
	Norton	do	do		41.8	39.0	
11	Newark and Rosendale.	do	do		35.5	40.0	14 days old, after grinding.
	Potomac	do	do		41.5	28.5	
12	Lehigh	Portland	do		25.9	79.0	
	Silica	do	do		25.6	35.0	
13	Alsen	do	do		42.2	79.0	Mixed with hot water.
	Steel	Slag	do		32.9	55.5	Do.
	Storm King	Portland	do		23.1	48.0	Do.
14	Alpha	do	do		29.6	105.0	Do.
	do	do	1	1	32.3	52.0	Do.
	Mankato	Natural	Neat		46.2	53.0	Do.
15	Bonneville Improved.	do	do		47.2	54.5	Do.
	Norton	do	do		43.8	55.0	Do
16	Alpha	Portland	1	1	32.3	52.0	
	do	do	1	2	46.2	36.0	
	do	do	1	3	56.1	31.0	
	do	do	1	4	77.8	29.0	
17	Star, with plaster	do	Neat		33.4	99.5	40 days old, after grinding.
	Star, without plaster.	do	do		35.7	88.5	Do.

COMPRESSION TESTS OF CEMENT AND MORTAR CUBES.

Cubes used in the determinations of temperature acquired during setting.

Specimens which in the first loading sustained 800,000 pounds, the full capacity of the testing machine, without rupture, were reloaded, concentrating the load on a surface 10″ x 10″, or 8″ x 8″.25 on one compressed face of the cube.

Brand of cement.	Composition.			Age.	Weight.			Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Cement.	Sand.	Water.		Total.		Per cubic foot.	Height.	Compressed surface.				Total.	Per square inch.	
			Per cent.	Days.	Lbs.	ozs.	Pounds.	Inches.	Inches.	Inches.	Sq. inches.	Pounds.	Pounds.	Pounds.	
Alpha	Neat.	....	26.2	9	130	0	133.4	12.03	12.05	11.62	140.02		800,000	5,706	Not ruptured.
									12.05	11.62	140.02			4,966	
									10.00	10.00	99.72	442,200	695,300	6,973	Concentrated load.
Do	Neat.	....	22.5	13	131	0	133.7	12.04	12.03	11.69	140.63		800,000	5,689	Not ruptured.
									12.03	11.69	140.63			5,020	
									8.00	8.25	66.00	672,000	706,000	10,697	Concentrated load.
Do	Neat.	....	26.2	27	131	0	131.4	12.09	12.02	11.85	142.44				
														4,023	
									8.00	8.25	66.00	542,000	573,000	8,682	Do.
Alpha [Retarded 2 hours.]	Neat.	....	26.2	27	135	0	135.4	12.05	12.08	11.84	143.03	770,000	800,000	....	Not ruptured.
											143.03			5,593	Concentrated load.
									10.00	10.00	99.72	....	800,000	8,022	Not ruptured.
									12.08	11.84	143.03			3,988	Concentrated load.
									8.00	8.25	66.00	430,000	570,400	8,642	Ruptured.
Alpha	1	1	32.3	27	135	0	136.1	12.08	12.04	11.78	141.83		800,000	5,641	Not ruptured.
											141.83			4,357	
									8.00	8.25	66.00	618,000	618,000	9,364	Concentrated load.
Do	1	2	46.2	27	130	8	130.5	12.03	12.08	11.89	143.63	537,200	537,200	3,740	
Do	1	3	56.1	27	125	8	125.6	12.06	12.03	11.90	143.16	349,500	349,500	2,441	
Do	1	4	77.8	27	123	0	123.0	12.05	12.10	11.85	143.38	222,100	222,100	1,549	
Do	Neat.	....	30.0	27	128	0	131.4	12.04	12.04	11.61	139.78		800,000	5,723	Not ruptured.
														4,092	
									8.00	8.25	66.00	490,000	572,000	8,667	Concentrated load.
Do	Neat.	....	35.0	27	127	0	127.3	12.03	12.06	11.88	143.27	797,000	800,000	5,584	Not ruptured.
														3,458	
									8.00	8.25	66.00	....	495,500	7,508	Concentrated load.
Do	Neat.	....	29.6	9	126	8	126.2	12.03	12.02	11.98	144.00	450,900	450,900	3,131	Mixed with hot water.
Do	1	1	40.6	9	130	0	130.3	12.05	11.86	12.07	143.15	452,000	452,000	3,158	Do.
Atlas	Neat.	....	22.7	9	137	0	137.5	12.05	12.08	11.83	142.91	666,100	696,200	4,872	
Do	Neat.	....	38.8	13	126	0	125.1	12.04	12.07	11.98	144.60	361,000	370,500	2,562	8 hours retarded, at rest.
Do	Neat.	....	29.0	13	134	0	132.2	12.04	12.02	12.10	145.44	493,000	581,200	3,996	8 hours retarded, agitated.
Do	Neat.	....	32.0	13	130	8	130.7	12.07	12.06	11.85	142.91	599,200	599,200	4,193	5 hours retarded, at rest.

COMPRESSION TESTS OF CEMENT AND MORTAR CUBES—Continued.

Brand of cement.	Composition.			Age.	Weight.			Dimensions.			Sectional area.	Ultimate strength.			Remarks.
	Cement.	Sand.	Water.		Total.		Per cubic foot.	Height.	Compressed surface.			First crack.	Total.	Per square inch.	
			Per cent.	*Days.*	*Lbs.*	*ozs.*	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
Atlas	Neat.	....	26.0	13	135	8	135.5	12.05	12.03	11.92	143.40	598,000	676,000	4,714	5 hours retarded, agitated.
Do	Neat.	....	24.8	13	135	0	135.5	12.04	12.06	11.86	143.03	561,000	781,000	5,460	2 hours retarded, at rest.
Do	Neat.	....	23.6	13	136	0	135.9	12.07	12.07	11.87	143.27	740,000	810,000 795,000	5,654 5,549	2 hours retarded, agitated. Sustained 810,000 pounds without rupture. Load released and reapplied when rupture occurred under 795,000 pounds load.
Star	Neat.	....	26.5	8	130	8	130.6	12.07	12.08	11.84	143.03	370,200	370,200	2,588	
Storm King	Neat.	....	27.0	8	127	0	129.2	12.04	12.03	11.73	141.11	175,700	181,000	1,283	
Do	Neat.	....	23.1	8	133	0	130.9	12.06	12.05	12.08	145.56	135,300	135,300	930	Mixed with hot water.
Alsen	Neat.	....	29.4	13	124	8	128.4	12.02	12.02	11.60	139.43	402,100	402,100	2,884	
Do	Neat.	....	42.2	13	113	4	114.2	12.05	12.05	11.81	142.31	171,000	171,000	1,202	Do.
Dyckerhoff	Neat.	....	27.5	8	125	8	128.1	12.07	12.09	11.60	140.24	217,000	217,000	1,547	
Do	Neat.	....	25.0	13	130	0	130.9	12.03	12.04	11.85	142.67	282,400	282,400	1,979	
Josson	Neat.	....	29.7	13	123	8	128.1	12.09	12.03	11.45	137.74	349,000	349,000	2,534	
Steel	Neat.	....	35.6	8	111	8	112.6	12.02	12.08	11.78	142.30	169,600	169,600	1,192	
Do	Neat.	....	32.9	8	116	4	115.3	12.06	12.03	12.00	144.36	98,700	101,200	701	Do.
Austin	Neat.	....	40.0	13	119	0	118.8	12.05	12.06	11.91	143.63	52,000	52,000	362	
Bonneville Imported	Neat.	....	37.6	8	111	8	110.8	12.09	12.04	11.95	143.88	95,200	95,200	662	
Do	Neat.	....	47.2	8	107	4	106.5	12.05	12.00	12.03	144.36	20,500	20,500	142	Do.
Hoffman	Neat.	....	36.5	8	116	0	115.1	12.00	12.03	12.06	145.08	49,700	50,700	349	
Norton	Neat.	....	41.8	9	111	0	112.0	12.05	12.04	11.80	142.07	73,200	75,100	528	
Do	Neat.	....	43.8	9	111	8	111.0	12.04	12.00	12.02	144.24	31,600	31,600	219	Do.
Obelisk	Neat.	....	35.0	13	117	8	116.7	12.05	12.07	11.96	144.36	121,200	121,200	840	
Mankato	Neat.	....	44.6	13	109	0	107.5	12.04	12.09	12.04	145.56	101,800	101,800	699	
Do	Neat.	....	46.2	13	107	12	106.9	12.04	12.05	12.00	144.60	59,600	59,600	412	Do.

RETARDED SETS.

These results comprise tests of cements which were mixed with water and allowed to remain different intervals of time, subjected to different treatment during those intervals, finally tamping the material into the molds where it hardened undisturbed, and subsequently determining the compressive strength of the samples.

There were experiments in which the cement, after initially adding the water, was allowed to remain at rest excepting such times as material for samples was withdrawn, when the whole mass was worked over and restored to its primitive consistency by the addition of water, and so continuing until the whole quantity of material was exhausted. In other cases the cement was kept in a state of nearly constant agitation in the mixing bed by the continuous use of the hoe, adding water from time to time in order to keep the material at the desired consistency, taking out samples at regular intervals. In still other cases only the material withdrawn at intervals for samples was regauged with water, allowing the main body to remain undisturbed in the mixing bed. After aging in the air the several samples were tested for strength under loads of compression.

The figures in the first columns of the tables indicate the time, in hours, intervening between mixing and putting the material into the molds.

ALPHA PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples or when regauging. Age when tested, 30 days.

Original quantities:	Pounds.
Cement	105.5
Water	26.1 per cent = 27.5

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent, approximate.
Initial mixing	27.5	26.1
2	.25	26.4
6	.12	26.7

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	5.99	6.03	5.95	35.88	249,000	256,500	7,148	
0	6.00	6.02	5.98	36.00	253,000	266,800	7,411	
2	6.00	6.05	5.95	35.40	217,000	218,400	6,169	
4	6.02	5.99	6.06	36.30	211,000	272,000	7,493	
4	6.02	6.00	5.98	35.88	231,000	244,000	6,800	
6	6.04	5.99	6.04	36.18	243,000	245,100	6,774	
8	6.03	5.98	6.01	35.93	198,000	254,500	7,083	
8	4.07	4.03	4.00	16.12	92,000	104,200	6,464	
8	4.06	4.03	4.02	16.20	104,000	110,300	6,808	
8	1.99	2.01	2.05	4.12	22,500	23,900	5,800	

STAR PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 30 days.

Original quantities:		Pounds.
Cement		94
Water	27.6 per cent=	25

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent, approximate.
Initial mixing	21.5	27.6
2	.5	28.3
6	.12	....

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.04	6.01	6.08	36.54	128,500	128,500	3,516	
0	6.01	5.98	6.05	36.18	125,300	125,300	3,463	
2	6.06	6.07	6.03	36.60	136,800	136,800	3,737	
4	5.99	6.07	5.99	36.35	138,900	138,900	3,821	
4	6.01	6.06	6.02	36.48	134,500	134,500	3,686	
6	6.02	6.01	6.04	36.30	141,700	141,700	3,903	
8	5.97	6.02	5.60	33.71	131,100	131,100	3,889	

STORM KING PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 31 days.

Original quantities:		Pounds.
Cement		93.5
Water	29.4 per cent=	27.5

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent, approximate.
Initial mixing	27.5	29.4
2	.75	30.4
4	.5	31.6
6	1	34.2
8	.75	37.6

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.08	5.98	6.06	36.23	63,600	65,500	1,802	
0	6.00	6.01	5.99	36.00	54,500	64,200	1,783	
2	6.06	6.00	6.00	36.00	48,600	57,600	1,599	
4	5.99	6.04	6.07	36.67	52,500	56,200	1,532	
4	6.06	6.00	6.11	36.66	51,600	53,500	1,459	
6	6.03	5.97	6.06	36.20	41,500	41,700	1,151	
8	6.03	5.99	6.08	36.41	27,300	28,808	791	
8	4.02	4.01	4.06	16.29	12,900	13,300	816	
8	1.92	2.01	2.07	4.17	2,850	2,850	683	

DYCKERHOFF PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals, first and last hours excepted. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 31 days.

Original quantities:	Pounds.
Cement	213
Water	28.6 per cent = 61

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent approximate.
Initial mixing	61.0	28.6
4	1.0	29.1
12	2.0	30.4
14¼	2.0	31.3
16	2.5	34.4
18	0.75	34.4
20	0.5	35.8
24	1.0	37.5

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.00	6.01	5.92	35.58	126,300	126,300	3,549	Age, 32 days.
1	6.00	6.08	5.93	36.05	129,800	132,200	3,667	Do.
2	5.99	6.04	5.92	35.75	112,500	122,000	3,412	Do.
4	6.01	6.05	5.99	36.24	123,300	123,300	3,402	Do.
6	6.03	6.07	6.02	36.55	97,800	98,200	2,686	
8	6.02	6.04	6.00	36.24	88,400	88,400	2,439	
10	6.00	6.03	6.08	36.67	84,800	84,800	2,312	
12	6.00	6.10	6.08	37.09	70,400	70,400	1,898	
14	5.98	6.10	6.04	36.84	64,300	64,300	1,745	
16	6.05	5.99	6.02	36.05	62,800	63,400	1,758	
18	5.98	6.07	6.00	36.42	60,000	60,700	1,666	
20	5.98	6.03	6.03	36.37	61,500	61,500	1,690	
22	6.00	6.01	6.03	36.24	55,900	56,900	1,570	
24	5.97	6.00	6.04	36.24	56,200	57,300	1,581	
25	6.05	6.00	6.00	36.36	56,900	57,400	1,578	
25	6.04	5.98	6.01	35.93	54,900	57,200	1,591	
25	4.01	4.05	4.07	16.49	26,600	26,600	1,613	Do.
25	1.94	2.02	2.10	4.24	5,860	5,860	1,382	Do.
25	1.93	2.01	2.10	4.22	5,960	5,960	1,412	Do.
25	2.01	1.92	2.13	4.09	5,180	5,180	1,266	Do.

DYCKERHOFF PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals, first hour excepted. Main batch of cement kept in a state of agitation in the mixing bed until put into the molds. Age when tested, 31 days.

Original quantities:	Pounds.
Cement	207
Water	29.5 per cent = 61

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent approximate.
Initial mixing	61.0	29.5
10	1.0	30.0
16	0.25	30.0
20	0.12	31.0

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	5.99	6.06	6.06	36.72	104,500	109,200	2,973	
1	6.00	6.10	6.05	36.90	119,900	120,400	3,262	
2	6.07	5.98	6.01	35.93	107,900	114,500	3,186	
4	6.07	5.98	6.11	36.71	102,200	102,200	2,783	
6	5.98	6.10	6.26	38.19	104,400	104,400	2,733	
8	5.99	6.10	6.02	36.72	98,900	98,900	2,693	
10	5.97	6.03	6.14	37.02	83,400	83,400	2,252	
12	5.98	6.05	6.15	37.20	69,600	71,800	1,928	
14	5.98	6.02	6.08	36.60	62,900	62,900	1,718	
16	5.98	6.01	6.07	36.49	65,800	65,800	1,803	
18	6.05	6.00	6.06	36.36	64,600	64,600	1,776	
20	5.98	6.04	5.50	33.22	57,100	57,100	1,718	

JOSSON PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 30 days.

Original quantities:	Pounds.
Cement	101
Water 30.2 per cent =	30.5

Cement in top of barrel was lumpy.
After the initial mixing no additional water was needed.

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.00	6.06	6.01	36.42	109,000	119,000	3,267	
0	6.00	6.01	5.95	35.75	121,200	121,200	3,390	
2	6.05	6.00	5.95	35.82	121,000	125,300	3,498	
4	6.02	6.01	5.93	35.63	139,700	139,800	3,923	
4	6.06	6.00	5.89	35.88	132,200	133,900	3,731	
6	6.01	5.97	6.02	35.93	129,900	132,800	3,696	
8	5.98	6.03	5.99	36.11	124,000	139,000	3,849	
8	4.05	4.11	3.99	16.40	59,300	59,300	3,615	
8	4.05	4.09	4.05	16.56	56,000	56,000	3,381	
8	2.03	1.96	2.01	4.00	9,720	9,720	2,430	
8	1.95	2.04	2.06	4.20	11,550	11,550	2,749	

STEEL, SLAG, CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 31 days.

Original quantities:	Pounds.
Cement	80.5
Water	36 per cent= 29

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent, approximate.
Initial mixing	29.0	36.0
2	0.5	36.9
4	0.5	38.5
6	0.5	40.0
8	0.25	40.5

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	5.98	6.04	6.00	36.24	42,700	42,700	1,178	
0	6.02	6.02	5.96	35.88	41,100	41,500	1,156	
2	6.06	6.07	6.03	36.60	40,600	41,400	1,131	
4	6.00	6.04	6.10	36.84	38,800	38,800	1,053	
4	6.04	6.00	6.05	36.30	36,000	36,900	1,016	
6	6.02	6.04	6.00	36.24	36,400	36,400	1,004	
8	6.03	6.00	6.08	36.48	32,300	35,100	962	
8	4.03	4.01	3.88	15.55	11,900	13,500	868	

AUSTIN, NATURAL CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 30 days.

Original quantities:		Pounds.
Cement		82.5
Water	39.4 per cent=	32.5

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent, approximate.
Initial mixing	32.5	39.4
2	3.5	45.1
4	2	49
6	.5	50.2
8	.25	51

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.04	6.01	6.09	36.60	26,600	26,600	727	
0	6.03	6.02	6.10	36.72	25,000	26,100	711	
2	6.05	6.00	6.13	36.78	15,600	15,600	724	
4	6.02	5.98	6.11	36.53	10,300	12,800	350	
4	5.99	6.02	6.08	36.60	10,700	12,100	331	
6	6.02	6.00	6.10	36.60	9,800	10,100	276	
8	5.96	6.00	6.12	36.72	9,600	10,900	297	
8	4.01	4.02	4.03	16.20	3,810	3,810	235	
8	4.01	4.03	3.99	16.08	3,900	4,300	267	
8	1.95	2.02	2.05	4.14	710	710	171	
8	2.01	1.96	2.04	4.00	640	640	160	
8	2.02	1.96	2.06	4.03	590	620	153	
8	2.02	1.96	2.05	4.01	630	630	157	

BONNEVILLE IMPROVED, NATURAL CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals, excepting the first and last hours. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 34 days, excepting the 7-hour samples, which were 35 days old.

Original quantities:	Pounds.
Cement	66.75
Water	42.7 per cent= 28.5

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent, approximate.
Initial mixing	28.5	42.7
1	4.5	52.1

No more water was needed in this batch.

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	5.98	6.03	6.14	37.02	32,900	33,800	913	
0	5.97	6.02	6.15	37.02	28,300	32,500	878	
1	5.97	6.03	6.02	36.30	10,500	11,700	322	Voids.
2	6.03	5.93	6.02	35.70	8,400	13,800	387	
4	6.01	5.93	5.96	35.34	9,900	13,700	388	
6	6.05	5.99	5.98	35.82	13,600	13,900	388	
7	4.00	4.01	3.95	15.83	4,600	6,480	409	
7	4.01	3.99	3.97	15.84	6,200	6,900	435	
7	4.00	4.06	3.98	16.15	6,300	6,950	430	

NORTON, NATURAL CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples, or when regauging. Age when tested, 34 days.

Original quantities:		Pounds.
Cement		68.75
Water	42.9 per cent=	29.5

Water added to the main batch as follows:

Interval after mixing, hours.	Water used.	
	Pounds.	Per cent, approximate.
Initial mixing	29.5	42.9
2	2.5	46.1
4	1.0	48.7
6	0.25	50.1

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.01	6.03	6.15	37.08	25,200	25,200	680	
0	6.05	6.01	6.14	36.90	27,550	27,550	747	
2	6.00	6.03	6.07	36.60	16,200	16,200	443	
4	5.98	5.95	5.90	35.10	10,100	11,200	319	Voids.
4	5.98	5.96	5.00	35.76	11,900	12,900	361	
6	5.93	5.00	5.86	35.16	11,700	14,900	424	
8	5.99	5.92	5.90	34.92	6,700	13,200	378	

STAR PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at intervals, as indicated in the tables which follow. Main batches of cement kept in a state of agitation in the mixing bed until put into molds.

Two kinds of cement were used of the above brand, one the ordinary commercial mixture containing plaster, the usual "restrainer," to control the rate of setting; the other kind the same as the first, but without the use of plaster. Age when tested, 30 days from the time of mixing.

The cement with plaster was mixed when 40 days old, that without plaster when 45 days old, from the time of grinding.

Original quantities:		Pounds.
Cement, with plaster		375
Water	32.9 per cent=	123.5
Cement, without plaster		375.75
Water	42 per cent=	158

Water was added to the batches as follows:

STAR PORTLAND CEMENT, WITH PLASTER.

Interval after mixing.	Water used.		Interval after mixing.	Water used.	
	Succes-sive.	Total.		Succes-sive.	Total.
Hrs. min.	*Pounds.*	*Pounds.*	*Hrs. min.*	*Pounds.*	*Pounds.*
Initial mixing	123.5	123.5	27 00	1.0	223.5
			28 00	2.0	225.5
4 00	3.0	126.5	29 00	1.0	226.5
4 15	1.0	127.5	30 30	1.0	227.5
4 30	4.0	131.5	32 00	2.0	229.5
4 50	9.0	140.5	34 00	1.0	230.5
5 10	8.0	148.5	35 00	1.0	231.5
5 30	8.0	156.5	37 00	1.0	232.5
6 00	7.0	163.5	39 00	1.0	233.5
6 15	6.0	169.5	40 30	1.0	234.5
6 50	4.0	173.5	41 30	1.0	235.5
7 05	8.0	181.5	46 00	1.0	236.5
8 00	4.0	185.5	47 00	1.0	237.5
8 45	4.0	189.5	50 00	1.0	238.5
9 30	4.0	193.5	51 10	2.0	240.5
9 50	2.0	195.5	52 00	2.0	242.5
12 00	2.0	197.5	54 30	1.0	243.5
13 00	1.0	198.5	56 00	1.0	244.5
13 30	1.0	199.5	60 00	2.0	246.5
14 00	1.0	200.5	62 00	1.0	247.5
14 50	1.0	201.5	64 00	2.0	249.5
16 00	2.0	203.5	68 00	1.0	250.5
17 00	2.0	205.5	70 00	1.0	251.5
18 00	1.0	206.5	72 00	2.0	253.5
19 10	3.0	209.5	74 00	1.0	254.5
20 00	2.0	211.5	76 00	1.0	255.5
21 00	1.0	212.5	78 00	1.0	256.5
22 00	3.0	215.5	82 00	1.0	257.5
23 00	3.0	218.5	88 00	1.0	258.5
24 00	1.0	219.5	92 00	1.0	259.5
25 00	1.0	220.5	96 00	.5	260.0
26 00	2.0	222.5	100 00	.5	260.5

STAR PORTLAND CEMENT, WITHOUT PLASTER.

Initial mixing	158.0	158.0	34 00	2.0	189.0
			36 00	1.0	190.0
7 30	2.0	160.0	38 00	1.5	191.5
8 30	1.0	161.0	40 00	1.5	193.0
9 00	2.0	163.0	42 00	1.0	194.0
10 00	1.0	164.0	44 00	1.5	195.5
11 00	1.0	165.0	54 20	0.5	196.0
12 00	2.0	167.0	56 00	1.0	197.0
14 00	2.0	169.0	58 00	1.0	198.0
16 00	2.0	171.0	64 00	1.0	199.0
18 00	2.0	173.0	68 00	0.5	199.5
19 30	1.0	174.0	70 00	0.5	200.0
22 00	2.0	176.0	71 40	1.0	201.0
23 00	1.0	177.0	78 50	0.5	201.5
24 00	2.0	179.0	81 00	0.5	202.0
25 00	1.0	180.0	85 00	1.0	203.0
26 00	2.0	182.0	90 00	0.5	203.5
28 00	2.0	184.0	92 00	0.25	203.75
30 00	1.0	185.0	96 00	0.25	204.0
32 00	2.0	187.0	98 00	0.25	204.25

STAR PORTLAND CEMENT, WITH PLASTER.

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	4.07	3.99	3.72	14.84	49,000	71,700	4,832	
0	4.00	4.07	3.70	15.06	91,900	91,900	6,102	
1	4.08	3.99	3.89	15.52	66,100	66,100	4,259	
1	4.04	3.99	3.94	15.72	75,000	79,400	5,051	
2	3.99	4.02	4.00	16.08	84,000	101,200	6,294	
2	4.07	3.99	4.00	15.96	84,000	104,500	6,548	
3	3.98	4.01	4.00	16.04	109,800	109,800	6,845	
3	3.98	4.06	4.02	16.32	91,000	106,400	6,520	
4	3.98	4.05	4.03	16.32	85,000	86,200	5,282	
4	3.98	4.06	4.10	16.65	88,000	94,200	5,658	
6	4.01	3.98	4.00	15.92	37,500	37,500	2,356	
6	3.98	4.06	4.03	16.36	50,400	50,400	3,081	
8	4.02	3.97	4.02	15.96	44,600	44,600	2,794	
8	3.96	4.05	4.02	16.28	41,200	41,200	2,531	
10	3.95	4.02	4.12	16.56	39,800	40,400	2,440	
10	3.97	4.01	4.20	16.84	39,300	39,300	2,334	
12	4.05	3.97	3.94	15.64	36,900	36,900	2,359	
12	3.97	4.03	3.96	15.96	30,100	31,300	1,961	
14	4.01	3.97	4.06	16.12	22,000	33,000	2,047	
14	4.07	3.96	4.04	16.00	38,100	38,100	2,381	
16	3.95	4.02	4.07	16.36	35,300	35,300	2,158	
16	4.08	3.98	4.06	16.16	34,800	34,800	2,153	
18	4.04	3.98	4.07	16.20	34,200	34,200	2,111	
18	4.06	4.00	4.05	16.20	36,800	36,800	2,272	
20	4.05	3.96	4.04	16.00	29,300	29,300	1,831	
20	4.04	3.96	4.02	15.92	31,400	31,400	1,972	
22	4.03	3.98	4.06	16.16	33,700	33,700	2,085	
22	4.03	3.96	4.03	15.96	27,400	27,400	1,717	
24	4.03	3.97	4.04	16.04	25,600	24,600	1,596	
24	4.05	3.96	4.07	16.12	27,300	28,100	1,743	
26	4.07	3.98	4.07	16.20	23,700	23,700	1,463	
26	4.09	3.96	4.03	15.96	25,900	25,900	1,623	
28	4.09	3.97	4.02	15.96	24,400	24,400	1,529	
28	4.07	3.96	4.05	16.04	27,400	27,400	1,708	
30	4.01	3.97	4.03	16.00	21,800	21,800	1,363	
30	4.05	3.97	4.07	16.16	24,600	24,600	1,522	
32	3.98	4.03	4.01	16.16	19,000	19,500	1,207	
32	3.98	4.06	4.05	16.44	24,100	24,100	1,466	
34	3.95	4.05	4.01	16.24	20,100	20,100	1,238	
34	3.99	3.99	4.06	16.20	23,600	23,600	1,457	
36	4.03	4.01	3.98	15.96	17,200	18,300	1,147	
36	4.08	4.01	4.01	16.08	22,700	22,700	1,412	
38	4.10	4.02	4.02	16.16	22,500	22,500	1,392	
38	4.00	4.07	4.02	16.36	20,800	20,800	1,271	
40	4.00	4.04	4.00	16.16	20,000	20,000	1,238	
40	3.98	4.01	4.02	16.12	19,400	19,400	1,203	
42	4.02	3.96	3.99	15.80	15,300	15,300	968	
42	4.00	4.00	3.99	15.96	20,700	20,700	1,297	
44	3.99	4.10	3.97	16.28	20,600	20,600	1,265	
44	4.06	4.01	3.95	15.84	16,900	16,900	1,067	
46	4.02	3.99	4.02	16.04	19,300	19,300	1,203	
46	4.03	4.00	4.00	16.00	15,400	16,300	1,019	
48	3.95	4.01	4.00	16.04	19,100	19,100	1,191	
48	3.97	4.00	4.00	16.00	19,200	19,200	1,200	
50	3.96	4.00	4.00	16.00	19,800	19,800	1,238	
50	4.02	3.96	3.98	15.76	17,300	17,300	1,098	
52	3.95	4.02	4.00	16.08	17,100	17,400	1,082	
52	4.06	3.95	4.01	15.84	18,600	18,600	1,174	
54	3.95	4.00	4.00	16.00	18,400	18,400	1,150	
54	4.03	3.94	4.01	15.80	15,100	15,100	956	

STAR PORTLAND CEMENT, WITH PLASTER—Continued.

Hours.	Dimensions.			Sectional Area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
56	4.06	3.97	3.95	15.68	18,800	18,800	1,199	
56	3.99	3.96	3.92	15.52	18,200	18,200	1,173	
58	3.95	4.02	3.98	16.00	17,600	17,600	1,100	
58	3.97	4.00	3.99	15.96	19,400	19,400	1,216	
60	3.97	4.04	4.01	16.20	18,700	18,700	1,154	
60	4.01	3.95	4.00	15.80	18,100	18,100	1,146	
62	3.96	4.02	4.00	16.08	17,100	17,100	1,063	
62	3.96	4.00	3.97	15.88	18,400	18,400	1,159	
64	3.96	4.00	3.98	15.92	18,500	18,500	1,162	
64	3.97	4.02	3.96	15.92	17,100	17,100	1,074	
66	4.00	3.95	3.95	15.60	17,800	17,800	1,141	
66	3.95	4.02	3.96	15.92	16,500	16,500	1,036	
68	3.96	4.01	4.07	16.32	16,900	16,900	1,036	
68	4.09	3.98	3.99	15.88	13,800	13,800	869	
70	3.96	4.03	4.05	16.32	17,700	17,700	1,085	
70	4.01	3.94	4.04	15.92	14,600	14,600	917	
72	4.07	3.95	3.96	15.64	14,300	14,300	914	
72	3.97	4.07	3.99	16.24	15,200	15,200	936	
74	4.03	3.96	3.96	15.68	14,800	14,800	944	
74	4.03	3.92	4.01	15.72	14,400	14,400	916	
76	3.98	4.02	3.99	16.04	17,300	17,300	1,079	
76	4.00	3.94	4.01	15.80	13,700	13,700	867	
78	4.01	3.98	4.05	16.12	14,100	14,100	875	
78	4.05	3.96	4.06	16.08	15,200	15,200	945	
80	3.96	4.07	4.04	16.44	12,600	12,600	766	
80	3.97	4.10	3.98	16.32	12,400	12,400	760	
82	3.96	4.08	4.00	16.32	13,800	13,800	846	
82	3.97	4.06	3.97	16.12	15,100	15,100	937	
84	4.00	3.96	3.97	15.72	....	12,500	795	
84	3.98	4.03	3.99	16.08	....	14,500	902	
86	4.01	3.98	4.02	16.00	....	10,600	663	
86	4.01	3.96	4.03	15.96	....	12,200	764	
88	4.02	4.00	3.94	15.76	....	12,700	806	
88	4.03	4.00	3.96	15.84	....	14,500	915	
90	4.09	4.00	4.02	16.08	....	9,900	616	
90	4.08	4.00	4.01	16.04	....	13,300	829	
92	4.05	4.00	3.99	15.96	....	13,000	815	
92	4.05	3.99	3.97	15.84	....	9,300	587	
94	3.99	4.03	3.94	15.88	....	13,200	831	
94	4.00	4.00	3.92	15.68	....	11,400	727	
96	4.06	4.00	3.97	15.88	....	12,300	775	
96	4.09	4.00	3.99	15.96	....	11,000	689	
98	4.00	3.99	4.00	15.96	....	9,100	570	
98	4.00	3.99	3.99	15.92	....	9,400	590	
100	3.97	4.00	4.03	16.12	10,300	10,300	639	
100	4.03	3.96	4.02	15.92	....	11,500	722	
102	3.97	4.00	4.06	16.24	....	10,800	665	
102	4.00	3.96	4.08	16.16	....	11,100	687	

STAR PORTLAND CEMENT, WITHOUT PLASTER.

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	4.05	3.98	4.10	16.32	36,200	37,100	2,273	
0	4.08	3.97	4.07	16.16	41,300	41,300	2,556	
1	4.06	3.96	4.03	15.96	....	44,100	2,763	
1	4.02	3.97	4.07	16.16	....	39,200	2,426	
2	4.00	4.05	4.02	16.28	....	41,800	2,568	
2	4.02	4.00	4.06	16.24	....	41,500	2,555	
3	4.04	3.97	4.04	16.04	....	43,300	2,700	
3	4.06	3.98	4.03	16.04	....	42,500	2,650	
4	4.03	3.98	4.05	16.12	....	39,100	2,426	
4	4.07	3.98	4.03	16.04	27,800	30,600	1,908	
6	4.03	3.98	4.02	16.00	....	36,500	2,281	
6	4.06	4.00	4.03	16.12	....	36,800	2,283	
8	4.06	3.96	4.04	16.00	....	32,100	2,006	
8	4.02	3.97	4.07	16.16	....	32,900	2,036	
10	4.07	3.97	4.00	15.88	....	29,800	1,877	
10	4.08	3.98	4.02	16.00	....	28,900	1,806	
12	4.04	3.98	4.08	16.24	....	26,000	1,601	
12	4.00	3.96	4.04	16.00	....	23,700	1,481	
14	4.05	3.96	4.00	15.84	....	19,800	1,250	
14	4.01	4.02	3.97	15.96	....	19,700	1,234	
16	4.07	4.01	3.99	16.00	....	23,500	1,469	
16	4.05	4.00	3.98	15.92	....	22,100	1,388	
18	4.02	4.09	4.00	16.36	....	23,000	1,406	
18	4.06	3.99	4.00	15.96	....	21,200	1,328	
20	4.01	4.03	3.99	16.08	....	24,300	1,511	
20	3.98	4.04	3.94	15.92	....	22,100	1,388	
22	4.05	3.98	3.94	15.68	....	23,000	1,467	
22	4.00	4.04	3.93	15.88	....	21,500	1,354	
24	4.10	3.99	4.00	15.96	....	23,200	1,454	
24	4.05	4.00	3.98	15.92	....	23,400	1,470	
26	4.00	4.01	3.97	15.92	....	20,500	1,288	
26	4.00	3.99	4.00	15.96	....	18,800	1,178	
28	3.97	4.03	4.05	16.32	....	24,700	1,513	
28	3.98	4.04	4.06	16.40	....	23,200	1,415	
30	4.02	3.99	4.08	16.28	....	20,100	1,235	
30	3.98	4.01	4.02	16.12	....	19,300	1,197	
32	3.96	3.97	4.02	15.96	....	14,400	902	
32	3.96	4.04	4.06	16.40	....	17,800	1,085	
34	4.02	3.94	4.06	16.00	....	18,200	1,138	
34	4.00	3.94	4.06	16.00	....	17,100	1,069	
36	4.05	3.95	4.06	16.04	....	17,400	1,085	
36	3.96	4.00	4.07	16.28	....	18,200	1,118	
38	4.05	3.96	4.12	16.24	....	19,500	1,201	
38	3.96	4.01	4.05	16.24	....	17,600	1,084	
40	3.97	4.03	4.01	16.16	....	18,800	1,163	
40	4.02	3.99	4.04	16.12	....	17,400	1,079	
42	4.01	3.95	4.07	16.08	....	18,300	1,138	
42	3.98	4.07	4.00	16.28	....	18,700	1,149	
44	4.00	3.97	4.08	16.20	....	19,800	1,222	
44	4.02	3.95	4.03	15.92	....	16,200	1,018	
46	4.00	3.98	3.94	15.68	....	17,600	1,122	
46	4.00	3.96	3.98	15.76	....	16,100	1,022	
48	4.03	3.94	4.05	15.96	....	15,300	959	
48	4.05	3.98	4.06	16.16	13,000	15,800	978	
50	4.06	3.97	4.03	16.00	....	17,500	1,094	
50	4.07	3.97	4.00	15.88	....	16,600	1,045	
52	4.08	3.96	4.01	15.88	....	16,600	1,045	
52	4.06	3.94	4.00	15.76	....	16,500	1,047	
54	4.06	3.95	4.10	16.20	....	19,400	1,198	
54	4.06	3.95	4.08	16.12	....	20,500	1,272	

STAR PORTLAND CEMENT, WITHOUT PLASTER—Continued.

Hours.	Dimensions,			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
56	4.00	3.94	4.08	16.16	....	21,900	1,355	
56	4.02	3.94	4.09	16.12	....	20,100	1,247	
58	4.00	3 93	4.07	16.00	....	19,300	1,206	
58	4.05	3.95	4.07	16.08	....	16,600	1,032	
60	4.00	3.94	4.02	15.84	....	17,200	1,086	
60	4.01	3.95	4.02	15.88	....	18,000	1,134	
62	3.94	4.00	4.04	16.16	....	18,900	1,170	
62	3.93	4.03	4.01	16.16	....	19,500	1,207	
64	3.95	4.03	4.00	16.12	....	19,000	1,179	
64	3.96	4.05	4.00	16.20	....	18,900	1,167	
66	4.00	3.98	4.02	16.00	....	15,500	969	
66	3.97	4.04	4.07	16.44	....	14,400	876	
68	3.97	4.04	3.99	16.12	....	13,800	856	
68	4.00	4.00	3.98	15.92	....	13,200	829	
70	4.01	4.07	4.00	16.28	....	14,000	860	
70	3.98	4.07	3.93	16.00	....	13,400	838	
72	4.00	4.00	3.90	15.60	....	11,900	763	
72	4.02	3.98	3.93	15.64	....	13,200	844	
74	4.01	4.00	4.00	16.00	....	14,100	881	
74	4.00	4.03	4.00	16.12	....	13,100	813	
76	4.05	4.00	3.96	15.84	....	13,800	871	
76	4.08	4.00	4.00	16.00	....	13,500	844	
78	4.00	4.00	3.96	15.84	....	13,400	846	
78	4.07	3.96	4.01	15.88	....	13,000	819	
80	3.95	4.01	4.11	16.48	....	14,100	856	
80	4.00	3.96	4.10	16.24	....	13,200	813	
82	3.93	4.05	4.08	16.52	....	13,300	805	
82	4.03	3.96	4.11	16.28	....	13,500	829	
84	4.02	3.96	4.03	15.96	....	11,200	702	
84	3.96	4.05	4.09	16.56	....	14,400	870	
86	4.05	3.97	4.06	16.12	....	13,700	850	
86	3.95	4.00	4.08	16.32	....	14,500	888	
88	3.96	3.99	4.01	16.00	....	14,200	888	
88	3.99	3.99	4.07	16.24	....	12,500	770	
90	4.01	3.94	4.05	15.96	....	12,700	796	
90	4.03	3.98	4.06	16.16	....	12,400	767	
92	3.95	4.02	4.09	16.44	....	13,300	809	
92	3.92	4.02	4.03	16.20	....	14,500	895	
94	3.94	4.00	4.00	16.00	....	14,100	881	
94	4.00	3.93	4.01	15.76	....	13,200	838	
96	3.93	4.01	4.06	16.28	....	14,600	897	
96	4.02	3.95	4.02	15.88	....	12,500	787	
98	4.03	3.95	4.05	16.00	....	12,800	800	
98	4.02	3.94	4.01	15.80	....	12,500	791	
100	4.02	4.00	4.00	16.00	....	12,100	756	
100	4.00	4.00	4.01	16.04	....	11.500	717	
102	3.98	4.08	3.98	16.24	....	13,900	856	
102	4.00	4.07	4.00	16.28	....	12,200	749	

STAR PORTLAND CEMENT.

RETARDED SET SERIES.

Additional tests after setting longer periods in air at ordinary and at low temperatures.

The intervals during which these samples were exposed to 0° F. temperature were preceded by setting in air at about 70° F. periods of 3 or 4 days each. This short period occurred immediately after mixing. After exposure to low temperatures the samples remained at about 70° F. the different intervals stated in the details of the tests.

CEMENT, WITH PLASTER.

Marks.	Hours retarded.	Time of setting in air at temperatures of— 0° F.		Time of setting in air at temperatures of— 70° F.		Dimensions. Height.	Dimensions. Compressed surface.		Sectional area.	Compressive strength. Total.	Compressive strength. Per square inch.	Remarks.
		Mos.	*Days.*	*Mos.*	*Days.*	*Ins.*	*Ins.*	*Ins.*	*Sq. in.*	*Pounds.*	*Pounds.*	
J 17	72	4	......	.....	4	1.98	1.98	2.00	3.96	2,270	573	
						2.03	2.00	2.02	4.04	1,700	421	
						1.98	2.01	2.00	4.02	2,040	507	
						2.03	2.01	2.03	4.08	2,200	539	
						2.00	2.00	2.01	4.02	2,800	696	
J 17	72	.....	......	4	......	1.99	1.98	2.01	3.98	1,540	387	
						1.98	1.97	2.02	3.98	1,400	352	
						1.99	1.99	1.99	3.96	1,210	306	
						1.99	2.00	2.01	4.02	1,640	408	
						2.01	1.99	2.02	4.02	1,480	368	
J 17	72	4	......	1	......	1.99	1.99	2.00	3.98	2,490	626	
						1.97	1.99	2.01	4.00	2,050	513	
						1.98	1.99	2.01	4.00	2,940	735	
						2.02	2.00	1.97	3.94	1,900	482	
						1.94	1.98	2.00	3.96	2,380	601	
J 17	72	5	......	.....	1	1.98	1.95	2.00	3.90	2,040	523	
						1.98	1.99	2.00	3.98	1,380	347	
						2.00	1.99	1.98	3.94	1,770	449	
						1.96	2.00	1.99	3.98	1,720	432	
						2.02	2.00	1.98	3.96	1,730	437	
J 17	72	.....	......	5	......	1.98	2.00	1.96	3.92	2,500	638	
						1.98	2.04	2.00	4.08	1,980	485	
						1.98	2.00	1.97	3.94	1,800	457	
						1.97	1.99	1.99	3.96	1,810	457	
						1.97	1.98	1.97	3.90	2,490	638	
J 17	72	.....	......	5	......	1.96	1.96	1.99	3.90	2,200	564	Heated at 110° C. to a constant weight before testing. Loss=19 per ct.
						1.97	1.96	2.00	3.92	2,590	661	
						1.98	2.01	2.00	4.02	2,250	560	
						1.98	2.00	1.99	3.98	2,400	603	
						1.96	1.98	2.00	3.96	2,200	556	
J 17	72	4	......	2	......	2.03	1.97	2.00	3.94	2,150	546	
						2.03	2.01	1.99	4.00	2,180	545	
						1.94	1.99	1.99	3.96	2,000	505	
						1.98	2.01	1.98	3.98	1,700	427	
J 17	96	4	......	.....	4	2.00	2.08	2.02	4.20	1,990	474	
						2.00	2.04	2.03	4.14	2,120	512	
						2.01	2.03	2.00	4.06	2,080	512	
						2.00	2.06	2.06	4.24	1,300	307	
						2.00	2.09	2.02	4.22	2,320	550	
J 17	96	.....	......	4	......	2.05	2.01	2.02	4.06	1,100	271	
						2.00	1.98	2.01	3.98	1,180	296	
						2.06	2.00	2.00	4.00	1,210	303	
						2.03	2.00	1.99	3.98	1,000	251	
						2.04	2.00	2.00	4.00	1,110	278	

CEMENT, WITH PLASTER—Continued.

Marks.	Hours retarded.	Time of setting in air at temperatures of— 0° F.		70° F.		Dimensions. Height.	Compressed surface.		Sectional area.	Compressive strength. Total.	Per square inch.	Remarks.
		Mos.	*Days.*	*Mos.*	*Days.*	*Ins.*	*Ins.*	*Ins.*	*Sq. in.*	*Pounds.*	*Pounds.*	
J 17	96	4	......	1	......	1.99	1.98	2.04	4.04	2,250	557	
						2.01	2.01	2.00	4.02	2,400	597	
						2.00	2.00	2.01	4.02	2,080	518	
						2.02	1.99	2.03	4.04	2,770	686	
						1.98	2.02	2.02	4.08	2,570	630	
J 17	96	5	......	......	1	2.12	2.01	2.00	4.02	1,610	401	
						2.02	2.01	2.02	4.06	1,930	475	
						2.09	2.01	2.00	4.02	1,980	493	
						2.01	2.01	2.00	4.02	1,800	448	
						2.02	2.00	2.04	4.08	1,300	319	
J 17	96	......	......	5	......	2.00	2.10	1.96	4.12	1,500	364	
						2.00	2.04	2.00	4.08	1,200	294	
						1.98	2.03	2.00	4.06	1,450	357	
						1.98	2.02	1.99	4.02	1,490	371	
						2.00	2.05	1.99	4.08	1,190	292	
J 17	96	......	......		......	2.02	2.00	1.97	3.94	2,000	508	Heated at 110° C. to a constant weight before testing. Loss=16 per ct.
						1.98	2.00	2.01	4.02	1,610	401	
						2.00	2.00	2.00	4.00	2,090	523	
						2.01	2.04	2.00	4.08	1,880	461	
						1.96	2.00	1.98	3.96	1,700	429	
J 17	96	4	......	2	......	2.00	2.00	2.00	4.00	1,800	450	
						2.00	1.96	2.00	3.92	1,400	357	
						2.00	2.02	2.06	4.16	2,100	505	
						1.98	2.05	2.03	4.16	2,120	510	
						1.99	2.04	2.03	4.14	1,980	478	
J 17	96	......	......	6	......	2.02	2.02	1.99	4.02	1,700	423	
						1.98	2.02	2.03	4.10	1,940	473	
						1.98	1.98	2.01	3.98	2,200	553	
						2.02	2.02	2.02	4.08	2,120	520	
						2.00	1.98	2.00	3.96	2,600	657	
J 17	102	......	......	6	......	4.01	3.93	3.94	15.48	5,700	368	
						4.03	3.91	3.95	15.44	8,800	570	
						2.96	2.98	2.99	8.91	6,300	707	
						2.98	3.00	2.97	8.91	5,700	640	

CEMENT WITHOUT PLASTER.

J 22	72	4	......	......	4	2.01	2.07	2.04	4.22	3,680	872	
						2.03	2.02	2.08	4.20	3,520	838	
						2.01	2.06	2.04	4.20	3,630	864	
						2.01	2.02	2.03	4.10	2,500	610	
						2.05	2.01	2.03	4.08	3,480	853	
J 22	72	......	......	4	......	1.99	2.08	2.03	4.22	1,740	412	
						2.00	2.00	2.04	4.08	1,200	294	
						2.06	2.00	1.99	3.98	1,690	425	
						2.03	2.01	2.01	4.04	1,100	272	
						2.06	2.00	2.01	4.02	1,310	326	
J 22	72	4	......	1	......	2.05	2.05	2.01	4.12	2,600	631	
						2.03	2.02	2.01	4.06	2,300	567	
						2.00	2.01	2.00	4.02	2,850	709	
						2.00	2.05	2.06	4.22	3,600	853	
						2.01	2.03	2.06	4.18	2,300	550	
J 22	72	5	......	......	1	2.00	2.02	2.08	4.20	2,600	619	
						1.99	2.03	1.96	3.98	2,550	641	
						2.00	2.02	2.02	4.08	3,200	784	
						2.01	2.05	1.99	4.08	2,550	625	
						2.02	2.03	2.00	4.06	2,900	714	
J 22	72	......	......	5	......	1.98	2.05	2.07	4.24	2,180	514	
						1.99	2.06	2.01	4.14	1,700	411	
						2.03	2.06	1.97	4.06	2,250	554	
						1.98	2.03	2.01	4.08	1,920	471	
						2.03	1.98	1.99	3.94	1,740	442	

CEMENT, WITHOUT PLASTER—Continued.

Marks.	Hours retarded.	Time of setting in air at temperatures of—				Dimensions.			Sectional area.	Compressive strength.		Remarks.
		0° F.		70° F.		Height.	Compressed surface.			Total.	Per square inch.	
		Mos.	*Days.*	*Mos.*	*Days.*	*Ins.*	*Ins.*	*Ins.*	*Sq. in.*	*Pounds.*	*Pounds*	
J 22	72	4	......	2	......	1.99	2.02	2.06	4.16	3,800	914	
						2.01	2.00	2.02	4.04	3,870	958	
						2.03	2.01	2.02	4.06	4,500	1,110	
J 22	72	......	......	6	......	2.03	2.01	1.99	4.00	2,250	563	
						1.98	2.01	2.01	4.04	1,920	475	
						1.99	1.99	2.00	3.98	2,000	502	
						1.99	1.99	2.01	4.00	2,300	575	
						1.99	2.03	2.00	4.06	2,010	495	
J 22	72	......	......	6	......	2.06	1.99	2.04	4.06	1,980	488	
						2.00	2.02	2.02	4.08	2,400	588	
J 22	96	4	......	......	4	1.99	2.00	2.01	4.02	4,390	1,090	
						1.98	1.99	2.03	4.04	3,900	965	
						1.99	2.03	2.00	4.06	2,480	611	
						1.96	1.99	2.01	4.00	2,890	723	
						2.00	2.00	2.01	4.02	2,660	662	
J 22	96	......	......	4	......	2.00	1.98	2.01	3.98	1,680	422	
						2.02	1.99	2.02	4.02	1,390	346	
						1.99	1.99	2.01	4.00	1,600	400	
						1.99	2.00	2.03	4.06	1,720	424	
						1.99	1.99	2.04	4.06	1,410	347	
J 22	96	4	......	1	......	1.98	2.00	1.98	3.96	2,000	505	
						1.96	2.00	2.02	4.04	2,730	676	
						1.99	2.01	1.99	4.00	2,700	675	
						1.98	1.98	1.98	3.92	2,850	727	
						1.98	2.00	1.98	3.96	3,100	783	
J 22	96	5	......	......	1	1.98	2.00	2.01	4.02	2,250	560	
						1.99	2.01	2.00	4.02	2,440	607	
						1.99	2.01	1.99	4.00	2,400	600	
						1.97	2.00	2.00	4.00	2,700	675	
						1.96	2.02	2.00	4.04	2,730	676	
J 22	96	......	......	5	......	1.97	2.00	1.96	3.92	2,310	589	
						1.94	2.03	1.96	3.98	1,900	477	
						1.98	2.00	2.04	4.08	2 130	522	
						2.05	1.98	1.98	3.92	2,200	561	
						1.98	2.03	1.97	4.00	2,000	500	
J 22	96	4	......	2	......	1.96	2.01	1.97	3.96	1,600	404	
						1.98	2.00	1.98	3.96	1,500	379	
						1.94	1.98	1.98	3.92	2,200	561	
						1.98	1.98	1.98	3.92	1,600	408	
						1.96	1.98	1.99	3.94	2,400	609	
J 22	96	......	......	6	......	2.00	2.00	1.96	3.92	2,700	689	
						1.96	2.00	2.03	4.06	2,280	562	
						1.97	2.01	1.98	3.98	2,900	729	
						1.99	2.04	1.96	4.00	2,250	563	
						1.96	2.00	1.96	3.92	2,600	663	
J 22	96	......	......	6	......	1.98	1.99	2.04	4.06	2,900	714	
						2.05	1.98	2.01	3.98	2,920	734	
J 22	102	......	......	6	......	3.94	4.02	3.94	15.84	12,600	795	
						3.96	4.05	4.02	16.28	12,000	737	

WHITEHALL PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2 hour intervals. Main batch of cement allowed to rest undisturbed in the mixing bed between the times of taking out samples or when regauging. Age when tested 32 to 38 days. The cement was mixed when 28 days old from the time of grinding.

Original quantities:	Pounds.
Cement	206
Water .... 28.6 per cent=	59

Water added to the main batch as follows:

Interval after mixing.	Water used.		Interval after mixing.	Water used.	
	Successive.	Total.		Successive.	Total.
Hrs. mins.	*Pounds.*	*Pounds.*	*Hrs. mins.*	*Pounds.*	*Pounds.*
Initial mixing	59.00	59.00	32 00	1.00	106.75
			34 00	1.00	107.75
2 00	1.75	60.75	36 00	1.00	108.75
4 00	2.50	63.25	38 00	1.00	109.75
6 00	5.00	68.25	40 00	1.00	110.75
8 00	5.50	73.75	42 00	.50	111.25
10 00	8.00	81.75	44 00	.50	111.75
12 00	6.00	87.75	46 00	.50	112.25
14 00	4.00	91.75	48 00	.25	112.50
16 00	3.00	94.75	50 00	.25	112.75
18 00	3.00	97.75	52 00	.25	113.00
20 00	2.00	99.75	54 00	.25	113.25
22 00	1.50	101.25	56 00	.25	113.50
24 00	2.00	103.25	58 00	.12	113.62
26 00	.50	103.75	60 00	.13	113.75
28 00	1.00	104.75	62 00	.12	113.87
30 00	1.00	105.75	64 00	.13	114.00

Hours.	Dimensions.			Sectional area.	Compressive strength.			Remarks.
	Height.	Compressed surface.			First crack.	Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	4.03	4.05	3.95	16.00	....	112,900	7,055	Age, 32 days.
0	4.07	4.09	3.93	16.07	....	113,700	7,075	Do.
2	4.04	4.12	3.99	16.44	92,000	109,200	6,642	Do.
2	4.09	4.08	4.02	16.40	....	118,900	7,250	Do.
4	4.06	4.01	4.03	16.16	85,000	97,400	6,027	Do.
4	4.05	4.04	4.00	16.16	81,000	103,200	6,386	Do.
6	3.99	4.06	4.00	16.24	104,000	109,100	6,718	Do
6	4.05	3.99	4.00	15.96	104,400	104,600	6,554	Do.
8	4.10	3.99	4.06	16.20	....	107,500	6,636	Age, 33 days.
8	3.99	4.06	4.04	16.40	96,400	98,300	5,994	Do.
10	3.98	4.09	4.02	16.44	....	72,200	4,392	Do.
10	4.05	3.98	4.00	15.92	58,000	65,700	4,127	Do.
12	3.98	4.01	4.03	16.16	59,500	62,400	3,861	Do.
12	3.98	4.06	4.08	16.56	47,100	50,300	3,037	Do.
14	4.02	3.98	4.00	15.92	....	63,100	3,964	Do.
14	3.98	4.01	4.04	16.20	30,000	51,000	3,148	Do.
16	3.99	3.98	4.08	16.24	35,000	51,600	3,177	Do.
16	3.98	4.06	4.09	16.61	49,200	53,400	3,215	Do.
18	3.98	4.00	4.07	16.28	48,800	50,200	3,084	Do.
18	3.98	4.05	4.01	16.24	....	48,400	2,980	Do.

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
20	3.99	4.05	4.08	16.52	47,400	51,500	3,117	Do.
20	3.97	4.06	4.07	16.52	....	52,400	3,172	Do.
22	3.99	4.07	4.05	16.48	41,800	50,100	3,040	Do.
22	3.97	4.01	3.97	15.92	....	46,600	2,927	Do.
24	3.98	4.00	3.95	15.80	....	44,900	2,842	Do.
24	4.03	3.97	4.01	15.92	41,100	42,300	2,657	Do.
26	3.99	4.09	3.98	15.28	48,800	52,200	3,416	Do.
26	3.98	4.10	3.98	16.32	43,200	43,200	2,647	Do.
28	4.09	3.99	4.02	16.04	....	48,400	3,018	Do.
28	3.98	4.04	4.00	16.16	....	44,000	2,723	Do.
30	3.97	4.10	4.05	16.61	....	44,100	2,655	Do.
30	3.96	4.04	4.01	16.20	40,200	42,100	2,599	Do.
32	4.04	3.97	4.00	15.88	....	39,600	2,494	Do.
32	3.98	4.05	4.05	16.40	....	42,500	2,592	Do.
34	3.98	4.06	4.01	16.28	36,400	37,100	2,279	Do.
34	3.98	4.09	4.01	16.40	....	40,200	2,451	Do.
36	4.06	4.00	4.00	16.00	....	38,700	2,419	Do.
36	4.05	3.98	3.99	15.88	....	35,200	2,217	Do.
38	3.99	4.10	3.99	16.36	....	43,100	2,635	Age 38 days.
38	4.10	3.97	4.01	15.92	40.100	41,700	2,619	Do.
40	4.06	3.98	4.00	15.92	....	34,200	2,148	Do.
40	3.98	4.08	3.97	16.20	....	33,600	2,074	Do.
42	4.05	3.98	4.04	16.08	....	27,300	1,698	Do.
42	3.98	4.06	3.99	16.20	32,000	34,500	2,130	Do.
44	4.06	3.98	3.99	15.88	27,600	28,900	1,788	Do.
44	3.98	4.02	3.99	16.04	....	38,400	2,394	Do.
46	4.04	4.00	3.98	15.92	30,300	31,300	1,966	Do.
46	4.00	4.03	4.00	16.12	27,700	28,700	1,780	Do.
48	4.01	3.96	3.95	15.64	28,700	30,100	1,925	Do.
48	3.96	4.03	3.96	15.96	28,700	29,600	1,855	Do.
50	4.01	3.98	3.99	15.88	....	34,400	2,166	Do.
50	3.97	4.00	4.01	16.01	30,200	30,700	1,914	Do.
52	4.04	3.98	4.00	15.92	....	30,400	1,910	Do.
52	3.97	4.01	3.97	15.92	29,600	30,100	1,891	Do.
54	3.99	3.97	3.96	15.72	....	28,800	1,832	Do.
54	3.96	4.06	3.99	16.20	23,600	27,300	1,685	Do.
56	3.94	4.04	4.03	16.28	29,500	32,400	1,990	Do.
56	4.04	3.96	3.99	15.80	24,200	26,700	1,690	Do.
58	4.00	3.95	4.02	15.88	24,600	26,600	1,675	Do.
58	4.01	3.95	4.02	15.88	24,800	25,500	1,606	Do.
60	3.97	4.09	3.98	16.28	23,000	23,300	1,431	Do.
60	4.07	3.97	3.95	15.68	....	20,700	1,320	Do.
62	3.97	4.02	4.00	16.01	22,400	22,900	1,428	Do.
62	3.99	3.98	3.99	15.88	....	23,200	1,461	Do.
64	4.03	3.98	3.98	15.84	18,700	19,100	1,206	Do.
64	3.97	4.06	2.97	16.12	12,500	19,500	1,210	Do.

STORM KING PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals, with one interval of 8 hours. Main batch of cement allowed to rest undisturbed in the mixing bed after the initial gauging, excepting two occasions, 8 hours after mixing, when 4 pounds of water was added, and 11 hours after mixing, when 1.75 pounds of water was added to the main batch. Material sufficient for each lot of two 6-inch cubes was detached from the main batch, reworked, and regauged when required, just before putting into the molds. Age when tested, 3 months.

Original quantities:	Pounds.
Cement	382
Water	29.3 per cent = 112

Water was added to the individual detached batches as follows:

Interval after mixing.	Water used.	Interval after mixing.	Water used.
Hours.	*Pounds.*	*Hours.*	*Pounds.*
18	2.5	26	3
20	3	28	5
22	2.25	30	4.5
24	2.25		

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.04	6.00	5.99	35.94	84,600	87,800	2,443	
0	6.07	6.04	6.05	36.54	92,000	93,100	2,548	
2	6.07	6.00	6.04	36.24	65,000	88,500	2,442	
2	6.04	6.05	6.08	36.78	63,000	93,100	2,531	
4	6.00	6.01	6.10	36.66	65,000	87,200	2,379	
4	6.00	6.02	6.03	36.30	63,500	88,100	2,427	
6	6.00	6.03	6.11	36.84	59,500	84,400	2,291	
6	5.99	6.03	6.01	36.24	89,100	89,100	2,459	
8	6.01	6.00	6.07	36.42	62,000	75,900	2,084	
8	5.99	6.06	6.10	36.97	69,700	69,700	1,885	
10	6.00	5.99	6.15	36.84	42,800	59,500	1,615	
10	6.01	5.98	6.19	37.02	56,000	61,600	1,664	
18	5.99	5.94	6.10	36.23	26,000	29,900	825	
18	6.01	6.00	6.11	36.66	26,700	28,400	775	
20	6.05	5.98	6.08	36.36	23,700	23,700	652	
20	6.00	6.00	6.10	36.60	22,500	24,200	661	
22	5.99	6.00	6.14	36.84	26,400	26,400	717	
22	6.00	6.02	6.12	36.84	22,600	22,600	613	
24	6.02	5.96	6.09	36.30	23,000	23,000	634	
24	5.98	6.00	6.08	36.48	24,300	26,200	718	
26	6.00	5.98	6.01	35.94	18,100	18,100	504	
26	5.98	6.02	6.02	36.24	20,400	20,400	563	
28	5.96	5.99	5.93	35.52	17,800	17,800	501	
28	6.00	5.96	6.04	36.00	18,500	18,500	514	
30	5.97	6.01	6.02	36.18	13,560	13,560	375	
30	5.98	6.00	4.20	25.20	7,600	7,600	301	Part of a cube.

NEWARK AND ROSENDALE NATURAL CEMENT.

RETARDED SET SERIES.

Samples taken out at 2-hour intervals, with one interval of 13 hours and one of 18 hours. Main batch of cement allowed to rest undisturbed in the mixing bed after the initial gauging. Material sufficient for each lot of two 6-inch cubes was detached from the main batch, reworked, and regauged when required, just before putting into the molds. Age when tested, 35 days. The cement, when mixed, was 14 days old from the time of grinding.

Original quantities:	Pounds.
Cement	2
Water	42.7 per cent = 1

Water was added to the individual detached batches as follows:

Interval after mixing.	Water used.	Interval after mixing.	Water used.
Hours.	*Pounds.*	*Hours.*	*Pounds.*
2	3.0	25	3.5
4	2.75	43	2.0
17	3.0	45	1.75
19	2.75	47	2.25
21	3.5	49	2.50
23	3.5		

This batch of material had set sufficiently 45 minutes after initial gauging to become somewhat resonant in the mixing bed. It was necessary to scrape off the material from the main batch for cubes 17 hours retarded and thereafter.

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.07	5.99	6.20	37.14	30,400	30,400	819	
0	6.00	6.00	6.18	37.08	27,800	27,800	750	
2	5.94	5.98	6.15	36.78	22,100	23,800	647	
2	5.94	6.01	6.09	36.60	....	23,900	653	
4	6.02	5.91	6.09	35.99	....	23,350	649	
4	5.94	5.98	6.10	36.18	....	23,200	636	
17	6.00	5.96	6.05	36.06	....	26,480	734	
17	6.00	5.94	6.17	36.65	....	25,250	689	
19	6.01	5.97	6.13	36.60	23,300	23,900	653	
19	6.00	5.99	6.09	36.48	....	25,500	699	
21	6.02	5.97	5.99	35.76	....	20,300	568	
21	5.99	5.94	6.05	35.94	19,300	19 500	543	
23	5.96	5.95	6.10	36.30	21,900	22,200	612	
23	5.96	6.01	6.11	36.72	....	22,400	610	
25	6.00	5.97	6.02	35.94	....	19,100	531	
25	6.02	5.98	6.11	36.54	....	16,900	463	
43	5.99	5.93	6.04	35.82	....	19,300	539	
43	5.98	5.94	6.10	36.23	18,500	19,100	527	
45	5.99	5.91	6.14	36.29	....	19,300	532	
45	5.97	5.93	6.04	35.82	....	19,200	536	
47	5.98	6.00	6.06	36.36	....	20,800	572	
47	5.99	5.94	6.06	36.00	....	20,200	561	
49	6.00	5.93	6.10	36.17	....	17,200	476	
49	5.95	5.95	6.02	35.82	....	15,800	441	

WHITEHALL PORTLAND CEMENT.

RETARDED SET SERIES.

Samples taken out at intervals, the main batch remaining undisturbed in the mixing bed after the initial gauging. The cement was mixed with 25.6 per cent water by weight. Lots of two 6-inch cubes were taken out immediately after gauging, and 2 hours and 4 hours later. The material for the second and third lots was regauged with 0.25 pound and 1.75 pounds of water, respectively. In subsequent lots the cement had set very hard in the mixing bed and required to be broken up with a pickax and reground in a mortar before regauging. This was reground to pass a 100-mesh sieve. About 40 per cent of water additional was used in regauging the material 24, 48, and 146 hours retarded.

The results show the cement retained its strength practically unchanged after an interval of 4 hours in the mixing bed, and that even 6 days thereafter the indurated material can be broken up, reground and regauged, and then reacquire a certain compressive strength. The samples were tested when 35 days old from the time of initial gauging.

Hours.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
0	6.07	6.03	5.98	36.06	165,000	214,100	5,940	
0	6.12	6.00	6.03	36.18	202,000	251,400	6,950	
2	6.24	6.00	6.05	36.30	236,000	245,100	6,750	
2	6.22	6.00	6.01	36.06	126,000	209,900	5,820	
4	6.02	5.99	6.14	36.78	196,000	249,900	6,790	
4	6.00	6.00	6.17	37.02	231,000	235,000	6,350	Dark colored fragments.
24	4.06	4.04	3.87	15.63	....	17,800	1,140	Light colored fragments.
24	4.03	4.05	3.90	15.80	....	18,100	1,150	
24	3.85	4.10	4.08	16.73	19,100	20,700	1,240	Seam across middle normal to applied stress.
48	4.09	4.09	3.90	15.95	....	11,500	721	
48	4.09	4.03	3.96	15.96	....	10,500	658	
146	4.07	4.01	4.00	16.04	....	11,200	698	
146	4.09	4.03	3.97	16.00	....	10,500	656	
146	4.01	4.01	4.05	16.26	....	10,900	666	
146	4.10	4.04	4.04	16.32	....	11,700	717	

A number of grouts were mixed in the afternoon, allowed to remain at rest in the mixing bed over night, a period of 15 to 16 hours, reworked in the morning, adding water if necessary to establish such a consistency as common in mortar for stone masonry or removing surplus water at this time, after which the material was put into molds. After setting about 30 days or more in the air, tests on compressive strength were made as follows:

ALPHA PORTLAND CEMENT.

RETARDED SET SERIES, GROUTS.

Original quantities: Cement, 97 pounds; water, 43.5 pounds=44.9 per cent.

Mixed and allowed to remain over night, 15 hours, in the mixing bed.

One pound of surplus water removed in the morning, leaving 42.5 pounds=43.9 per cent, in the mixture. Worked over and put into the molds.

Age when tested, 30 days.

Number.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	6.05	6.00	6.02	36.12	128,700	128,700	3,563	
2	6.05	6.06	6.09	36.90	123,900	124,500	3,373	
3	6.00	6.05	6.00	36.67	95,000	123,500	3,367	
4	5.99	6.01	6.00	36.42	122,000	135,000	3,706	
5	6.05	6.03	6.07	36.60	128,000	129,000	3,524	
6	6.00	6.03	6.00	36.18	119,500	119,500	3,302	
7	6.01	6.02	6.08	36.60	120,800	121,200	3,311	
8	6.00	6.02	5.98	36.00	133,000	133,000	3,694	
1	4.02	4.04	4.03	16.29	52,600	52,600	3,228	
2	4.03	4.03	4.00	16.12	51,000	55,300	3,430	

DYCKERHOFF PORTLAND CEMENT.

RETARDED SET SERIES, GROUTS.

Original quantities: Cement, 100.5 pounds; water, 43.5 pounds= 43.3 per cent.

Mixed and allowed to remain over night, 15 hours, in the mixing bed. Worked over in the morning and put into molds. No water needed.

Age when tested, 31 days.

Number.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	6.03	5.99	5.95	35.64	80,200	80,200	2,250	
2	6.00	6.02	5.97	35.94	71,000	72,500	2,017	
3	5.99	6.09	5.85	35.62	77,600	77,600	2,178	
4	5.99	6.05	5.86	35.45	77,800	77,800	2,194	
5	6.00	6.06	6.00	36.36	67,000	69,400	1,908	
6	6.06	5.98	5.86	35.04	73,900	73,900	2,108	
7	6.00	5.91	6.02	35.58	71,900	71,900	2,020	
8	6.04	5.98	5.88	35.17	78,500	78,500	2,231	
	4.03	4.06	3.91	15.88	37,600	38,000	2,392	

Josson Portland Cement.

RETARDED SET SERIES. GROUTS.

Original quantities: Cement, 90.5 pounds; water, 44 pounds=48.6 per cent.

Mixed and allowed to remain over night, 15 hours, in the mixing bed. Four and one-half pounds surplus water removed in the morning, leaving 39.5 pounds=43.7 per cent, in the mixture. Worked over and put into the molds. Age when tested, 30 days.

Number.	Dimensions.			Sectional area.	Compressive strength.			Remarks.
	Height.	Compressed surface.			First crack.	Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	6.00	6.08	6.06	36.84	71,000	72,800	1,976	
2	6.07	6.00	6.02	36.12	76,800	76,800	2,126	
3	6.05	5.99	6.03	36.11	72,000	73,600	2,038	
4	6.03	6.02	5.89	35.45	77,100	77,100	2,174	
5	6.05	6.00	6.07	36.42	72,100	72,100	1,979	
6	6.01	5.99	6.10	36.53	76,000	76,000	2,080	
7	6.00	6.02	5.92	35.63	82,100	82,100	2,304	
8	6.07	6.05	6.08	36.79	74,300	74,300	2,019	

Steel Slag Cement.

RETARDED SET SERIES, GROUTS.

Original quantities: Cement, 84.5 pounds; water, 43 pounds = 50.9 per cent.

Mixed and allowed to remain over night, 15 hours, in the mixing bed. Worked over in the morning and put into molds.

Age when tested, 30 days.

Number.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	6.02	5.97	6.03	36.00	19,200	20,200	561	
2	5.99	6.03	6.02	36.30	20,100	20,600	567	
3	5.97	6.02	6.05	36.42	19,520	19,520	536	
4	6.03	6.02	5.99	36.05	18,600	18,700	519	
5	6.02	6.05	6.05	36.60	20,500	20,500	560	
6	5.96	6.01	6.06	36.42	19,700	19,700	541	
7	5.97	6.01	6.07	36.49	20,600	20,600	565	
8	6.00	5.98	6.09	36.41	21,300	21,300	585	
	4.02	4.03	3.97	15.95	7,680	7,680	482	
1	1.94	2.02	2.01	4.07	1,170	1,360	334	
2	1.93	2.06	2.01	4.14	1,420	1,580	382	
3	2.02	1.96	2.05	4.01	1,560	1,560	389	
4	2.02	1.94	2.02	3.91	1,720	1,740	458	Voids.
5	2.01	1.93	2.04	3.93	1,460	1,510	384	Do.

Bonneville Improved Natural Cement.

RETARDED SET SERIES, GROUTS.

Original quantities: Cement, 70.5 pounds; water, 43.5 pounds = 61.7 per cent.

Mixed and allowed to remain over night, 16 hours, in the mixing bed. Five pounds surplus water removed in the morning, leaving 38.5 pounds = 54.6 per cent in the mixture. Worked over and put into molds. Lumpy at the time.

Age when tested, 31 days.

Number.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	5.93	6.02	5.86	35.28	7,920	7,920	224	
2	5.95	5.98	5.85	34.99	7,520	7,520	215	
3	6.02	6.15	5.56	34.20	6,340	6,340	185	
4	6.00	6.11	5.64	34.47	5,780	5,780	168	
5	5.96	6.02	5.88	35.40	6,500	6,790	192	
6	6.03	6.00	5.83	34.99	6,510	6,510	186	
7	6.00	6.05	5.82	35.21	7,160	7,160	203	
8	6.01	6.01	5.92	35.58	6,950	6,950	195	
	3.99	3.99	3.82	15.24	3,220	3,220	211	
1	1.93	1.99	1.98	3.94	570	965	245	
2	1.98	1.91	1.97	3.77	650	1,010	268	
3	1.91	2.00	1.99	3.98	1,050	1,050	264	

Hoffman Natural Cement.

RETARDED SET SERIES, GROUTS.

Original quantities: Cement, 74 pounds; water, 47.5 pounds = 64.2 per cent.

Mixed and allowed to remain over night, 16 hours, in the mixing bed. Worked over in the morning and put into molds. No water needed.

Age when tested, 31 days.

Number.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	5.90	5.98	5.78	34.57	8,900	8,900	257	
2	5.93	5.93	5.81	34.45	9,590	9,590	278	
3	5.97	5.88	5.77	33.92	8,720	9,820	290	
4	5.98	5.92	5.86	34.69	9,450	9,780	282	
5	5.93	5.96	5.84	34.80	9,730	9,730	280	
6	5.95	5.92	5.88	35.10	9,670	9,670	275	
7	5.90	5.94	5.80	34.45	9,020	9,020	262	
8	6.01	5.96	5.77	34.39	8,900	8,900	259	
	3.97	3.97	3.85	15.29	4,280	4,280	280	
1	1.99	1.91	1.97	3.77	980	1,145	304	
2	1.90	1.98	1.98	3.92	450	1,030	263	
3	1.90	1.98	1.98	3.92	1,420	1,420	362	

MANKATO NATURAL CEMENT.

RETARDED SET SERIES, GROUTS.

Original quantities: Cement, 72 pounds; water, 49.5 pounds=68.8 per cent.

Mixed and allowed to remain over night, 16 hours, in the mixing bed. Worked over in the morning and put into molds. No water needed.

Age when tested, 31 days.

Number.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	5.98	5.91	5.83	34.45	9,400	10,700	311	
2	5.90	5.96	5.82	34.69	10,950	10,950	316	
3	6.02	5.96	5.70	33.98	5,800	9,020	265	
4	5.97	5.96	5.93	35.34	9,500	10,100	286	
5	6.05	6.01	5.73	34.43	....	....	....	Split into halves in setting.
6	6.00	6.01	5.75	34.55	8,050	8,800	255	Corners gone.
7	5.92	5.95	5.80	34.51	8,300	10,900	316	
8	5.96	5.91	5.85	34.58	9,950	10,800	312	
1	3.99	4.00	3.86	15.44	3,800	4,480	290	
2	4.01	3.98	3.87	15.40	4,400	4,900	318	
3	3.98	3.99	3.91	15.60	5,300	5,570	357	

NORTON NATURAL CEMENT.

RETARDED SET SERIES, GROUTS.

Original quantities: Cement, 73 pounds; water, 43 pounds = 59 per cent.

Mixed and allowed to remain over night, 15 hours, in the mixing bed; 4 pounds of water added in the morning, making 47 pounds=64.5 per cent in the mixture. Worked over and put into molds.

Age, when tested, 31 days.

Number.	Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
1	5.98	5.91	5.90	34.87	9,400	11,900	341	
2	5.97	5.91	5.83	34.45	8,900	10,500	305	
3	5.97	5.96	5.90	34.81	10,400	11,600	333	
4	5.98	5.91	5.93	35.04	10,400	12,400	354	
5	5.97	5.90	5.93	34.99	9,500	11,200	320	
6	5.99	5.90	5.95	35.10	11,000	12,200	348	
7	5.98	5.91	5.96	35.22	12,080	12,900	366	
8	5.99	5.90	5.98	35.29	12,200	13,300	377	
1	3.99	3.97	3.84	15.24	3,300	4,600	302	
2	3.99	3.98	3.89	15.49	4,100	5,300	342	

THE BEHAVIOR OF CEMENTS DURING MIXING WITH AND WITHOUT THE PRESENCE OF A "RESTRAINER."

Tests made under the preceding heading on retarded sets include those on the strength of a Portland cement of the usual commercial mixture containing plaster of paris; also some of the same brand, kindly supplied by the manufacturers by request, without the addition of the "restrainer," so-called. The setting properties, as shown by the method with indentation needles, were modified in the manner desired, although the differences in the rate of setting were less conspicuous when a mixture of thin consistency was used.

Concerning the interval of time elapsing from the gauging of grout mixtures to the time when a state of plasticity was acquired and its absorption of the full amount of water present occurred, the cement containing plaster was the earlier to attain these phases when 60 per cent or more water was used. A conspicuous difference in behavior appeared between the two kinds of cement when, in their earlier days after grinding, the material was mixed with water having its temperature near the freezing point. The cement without plaster was mixed with 40 per cent water by weight at the temperature of about 32° F. The cement was poured into a bucket containing the water, stirring the mixture during the operation. There was a momentary interval after the full amount of cement had been added, during which the mixture had the consistency of a thin mortar or very thick grout. A few seconds later the mixture suddenly thickened, and when moved about separated into a granular, mealy mass. Using 50 per cent of water the result was the same as before; a dry, mealy mass was formed. With 60 per cent of water the mixture thickened immediately after the cement was all in, but did not attain so dry and thick a consistency as with the lower percentages of water. With higher percentages of water the mixtures became ordinary grouts.

The behavior described was characteristic of the cement without plaster. Corresponding experiments made with plaster additions present in the cement did not show the granular, mealy state in the mixtures, the results being ordinary grouts. These two kinds of cement were each 2 months old from the time of grinding, when the above observations were made. One month later the peculiar characteristics of the cement without plaster had largely disappeared. The 40 per cent mixture displayed enfeebled traits as before, and the 50 per cent mixture required 16 minutes after mixing to acquire a pasty state. Later examinations of the material showed it still retained this trait, which now displayed itself when a less amount of water was used than above mentioned. No observations were made upon cement less than 2 months old. The general results tend to associate this behavior with the absorption properties developed by cements in a greater or less degree after water has been added.

The compressive tests showed greater strength possessed by the material containing the plaster addition, so far at least as pertains to the time of setting covered by these experiments, and during the earlier periods of the series on retarded sets.

ABSORPTION OF WATER BY GROUT MIXTURES AND TESTS OF GROUTS.

Cement to which water at ordinary atmospheric temperatures has been added in sufficient quantities to at first produce a grout, may subequently thicken, the water disappearing apparently by absorption in he mixture. The interval of time necessary to accomplish this result varies with the amount of water used in a given kind of cement.

Experiments with Star Portland cement, with and without plaster, gave the following results:

Cement with plaster.		Cement without plaster.	
Quantity of water used.	Interval required for absorption.	Quantity of water used.	Interval required for absorption.
Per cent.	*Hours.*	*Per cent.*	*Hours.*
40	6½	40	4¾
50	7½	50	7½
60	11	60	15
		70	30¾
80	34	80	44
100	45		

In the above cases the full amount of water disappeared below the surface of the mixtures at the times stated. The mixtures were each stirred occasionally after the water was added. A moderate amount of stirring promoted the absorption of the water, while vigorous stirring sensibly retarded this action, and temporarily reduced the consistency of the grout. The interval of time required for the absorption of the water is necessarily approximately given, since the period is influenced by the manipulation, and some uncertainty exists as to the time when the period shall be judged to have reached its end.

Bearing upon this kind of phenomena, an examination of the details of the tests on retarded sets shows that at certain stages copious quantities of water were needed to maintain the desired consistency of the mixture. Thus with the Star Portland cement, with plaster, the interval between 4½ and 9½ hours after initial mixing was characterized by the addition of considerably more water than at any subsequent period. A large quantity of water was initially used with the same brand of cement without plaster in its composition, and this does not show so marked a period subsequently. With the Whitehall, 64 hours series, the interval of time between 4 hours and 20 hours was one in which much water was added. In the ordinary mixing of cement similar behavior is met with, and while in some instances definiteness is lacking, there appears reason for believing that these intervals mark different stages in the chemical activity of the material.

The tests which next follow were upon the material which was mixed with different percentages of water and allowed to remain in the mixing bed until the water used was absorbed. The mixtures were then put into molds, set in air, and tested when 30 days old.

STAR PORTLAND CEMENT, WITH PLASTER.

[40 per cent water. Remained in the mixing bed 6¼ hours.]

Dimensions.				First crack.	Compressive strength.		Remarks.
Height.	Compressed surface.		Sectional area.		Total.	Per square inch.	
Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
4.05	3.94	4.14	16.31	63,600	66,500	4,077	
4.05	3.94	4.13	16.27	52,000	67,400	4,143	
4.00	3.96	4.20	16.63	71,700	71,700	4,311	
4.04	3.97	4.24	16.83	74,700	74,700	4,439	

[60 per cent water. Remained in the mixing bed 11 hours.]

3.97	4.20	3.93	16.51	....	33,500	2,029	
4.03	4.15	3.92	16.27	....	31,300	1,924	
4.01	4.08	3.94	16.08	....	33,100	2,058	
4.00	4.14	3.94	16.31	....	32,400	1,987	
4.03	4.15	3.94	16.35	....	27,700	1,694	

[80 per cent water. Remained in the mixing bed 34 hours.]

4.08	4.00	4.07	16.28	....	25,100	1,542	
4.00	4.06	3.99	16.20	14,000	21,200	1,309	
4.03	4.00	4.10	16.40	....	25,700	1,567	
4.03	4.00	4.03	16.12	....	26,100	1,619	
4.03	4.00	4.05	16.20	....	25,900	1,599	

[100 per cent water. Remained in the mixing bed 45 hours.]

3.99	4.01	4.11	16.48	22,700	24,100	1,462	
4.00	4.01	4.07	16.32	....	20,200	1,238	
3.97	4.05	4.00	16.20	....	20,100	1,241	
3.98	4.02	4.00	16.08	21,500	22,300	1,387	
4.00	4.00	4.05	16.20	....	22,800	1,407	

STAR PORTLAND CEMENT, WITHOUT PLASTER.

[40 per cent water. Remained in the mixing bed 4¾ hours.]

Dimensions.			Sectional area.	First crack.	Compressive strength.		Remarks.
Height.	Compressed surface.				Total.	Per square inch.	
Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
4.01	3.97	4.20	16.67	51,100	54,900	3,293	
4.02	3.95	4.16	16.43	36,000	41,500	2,526	
4.02	3.94	4.13	16.27	45,900	52,200	3,208	
4.03	4.18	3.97	16.59	53,500	53,500	3,225	

[50 per cent water. Remained in the mixing bed 7¼ hours.

4.03	3.93	4.13	16.23	41,000	43,500	2,680	
4.04	3.94	4.14	16.31	41,100	41,100	2,520	
4.06	3.95	4.16	16.43	49,500	49,500	3,013	
4.00	3.95	4.18	16.51	49,100	49,100	2,974	
4.00	3.95	4.17	16.47	47,000	50,400	3,060	

[60 per cent water. Remained in the mixing bed 15 hours.]

4.01	4.13	3.93	16.23	41,600	41,600	2,563	
4.08	4.17	3.95	16.47	39,100	39,100	2,374	
4.02	4.11	3.95	16.23	39,800	39,800	2,452	
4.06	4.12	3.94	16.23	31,500	35,900	2,212	
4.00	3.95	4.15	16.39	36,500	38,700	2,361	

[70 per cent water. Remained in the mixing bed 30¾ hours.]

4.00	4.06	3.95	16.04	....	27,100	1,690	
4.05	4.15	3.95	16.39	....	28,900	1,763	
3.96	4.10	4.00	16.40	....	30,800	1,878	
4.03	4.12	3.94	16.23	26,800	29,100	1,793	
4.00	4.03	3.95	15.92	....	27,800	1,746	

[80 per cent water. Remained in the mixing bed 44 hours.]

3.97	4.10	4.01	16.44	....	26,700	1,624	Age 33 days.
3.95	4.11	4.02	16.52	....	27,400	1,659	Do.
3.95	4.07	4.06	16.52	....	26,900	1,628	Do.
4.05	4.22	3.95	16.63	....	28,400	1,708	Do.
3.95	4.13	4.03	16.64	....	23,400	1,707	Do.

The tests of grouts which were mixed with hot and cold water gave the results which follow. The temperature of the hot water used was 82° C. The cold water was at about freezing.

STAR PORTLAND CEMENT, WITHOUT PLASTER.

GROUTS MIXED WITH HOT OR COLD WATER.

Age when tested, 32 days.

[40 per cent ice water. Acquired a granular mealy state when mixed, immediately tamped into molds.]

Dimensions.			Sectional area.	Ultimate strength.			Remarks.
Height.	Compressed surface.			First crack.	Total.	Per square inch.	
Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
3.97	4.04	4.07	16.44	....	46,500	2,828	
3.96	4.07	4.03	16.40	....	44,600	2,720	
3.97	4.00	4.04	16.16	....	41,100	2,543	
3.96	4.03	4.09	16.48	....	41,300	2,506	
3.96	4.05	4.04	16.36	....	40,500	2,476	
[50 per cent ice water. Acquired a granular mealy state when mixed, immediately tamped into molds.]							
3.98	3.97	4.04	16.04	....	32,800	2,045	
3.97	4.00	4.05	16.20	....	33,400	2,062	
3.96	4.00	4.14	16.56	....	34,400	2,077	
3.96	4.00	4.13	16.52	....	34,100	2,064	
3.94	4.00	4.05	16.36	....	30,300	1,852	
[50 per cent hot water, 82° C. Remained a thin mortar 2½ hours and was then put into molds.]							
4.05	4.04	4.00	16.16	....	28,300	1,751	
4.10	4.07	4.00	16.28	....	30,100	1,849	
4.03	4.06	4.00	16.24	....	32,400	1,995	
4.01	4.05	4.05	16.40	....	31,000	1,890	
4.08	3.97	4.11	16.32	....	30,900	1,893	
[60 per cent ice water. Mixture thickened and was immediately put into molds.]							
4.03	3.95	4.03	15.92	....	21,600	1,357	
4.05	3.96	4.06	16.08	....	24,800	1,542	
4.02	3.95	4.10	16.20	....	23,200	1,432	
4.03	3.94	4.05	15.96	....	23,600	1,478	
4.06	3.95	4.07	16.08	....	22,700	1,412	
[64.7 per cent ice water. Originally mixed with 70 per cent water; excess water removed and put into molds 3 hours later.]							
3.95	4.04	4.09	16.52	26,900	33,500	2,028	
3.94	4.00	4.12	16.48	32,300	35,400	2,148	
3.96	3.98	4.11	16.36	28,000	29,400	1,797	
3.94	4.03	4.18	16.85	35,900	35,900	2,131	
4.00	3.96	4.06	16.08	31,100	31,100	1,934	
[71.1 per cent ice water. Originally mixed with 100 per cent water; excess water removed and put into molds 4 hours later.]							
3.95	4.03	4.07	16.40	18,500	18,500	1,128	
3.96	4.02	4.15	16.68	16,200	16,200	971	
3.95	3.95	4.14	16.35	14,000	15,100	924	
3.94	4.00	4.13	16.52	13,200	13,300	805	
3.94	4.00	4.13	16.52	14,400	14,900	902	

LOSS OF WEIGHT OF GROUTS SET IN AIR.

The quantity of water used in mixing is stated on the accompanying diagram. Two or three days were required after mixing for the material to acquire sufficient strength to admit of removal from the molds. Observations on the loss in weights began immediately thereafter and continued over a period of 28 days. The compression tests were made at the end of this period.

TESTS OF GROUTS, NEAT CEMENT.

Specimens used in loss in weight determinations. Set in air. Age, 1 month.

Brand.	Dimensions.			Sectional area.	Ultimate strength.		Remarks.
	Height.	Compressed surface.			Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	
Josson …………	6.02	5.99	5.60	33.54	77,100	2,299	
	6.07	6.00	5.66	33.96	83,400	2,456	
	6.06	6.00	5.80	34.80	85,100	2,445	
Steel …………	5.96	5.98	5.65	33.79	19,600	580	
	6.02	5.77	5.97	34.45	18,900	549	
	6.00	5.79	5.96	34.51	19,180	556	
Bonneville improved …………	6.00	6.08	5.99	36.42	18,200	500	
	6.00	5.97	6.16	36.78	19,100	519	
	6.05	6.00	6.06	36.36	15,580	428	
Hoffman …………	5.96	6.06	5.70	34.54	7,040	204	
	6.02	5.52	5.98	33.01	6,800	206	
	5.97	5.36	6.02	32.27	5,360	165	
Mankato …………	6.03	5.94	5.98	35.52	11,250	317	
	5.97	5.89	6.02	35.46	11,200	316	
	6.03	5.97	5.90	35.22	10,300	292	
Norton …………	6.00	6.00	6.11	36.66	9,920	271	
	5.99	6.03	6.23	37.57	9,920	264	
	6.02	5.98	6.18	36.96	10,300	279	

CEMENTS WHICH SET IN AIR AT DIFFERENT TEMPERATURES.

This series of experiments was made with a number of brands of domestic and foreign Portlands, a slag cement, and some natural cements. The several batches of material were gauged with sufficient water to insure a mixture of the consistency of ordinary mortar for stone masonry. Immediately after mixing, the material was put into 2-inch molds, with a few cubes of larger size and a number of tensile briquets. There were three general groups, one of which set in the open air of the testing laboratory at ordinary atmospheric temperatures, given in the details and tabulations as 70° F. The specimens belonging to the other two groups were placed in a cold-storage warehouse, where they remained the different intervals of time noted in the tests. One group was placed in a room known as a "Cooler," in which the temperature was maintained in the vicinity of 39°. The other group was placed in a room known as a "Freezer," in which the temperature is kept in the vicinity of 0° F., seldom varying more than 5° in either direction from this point, the thermometer more frequently indicating a temperature a few degrees below than above zero.

Each group was exposed to its prescribed temperature as soon after mixing as practicable. Specimens intended for the "Freezer" were mixed on cold days, with the thermometer in the vicinity of 15 to 20° F., at once exposed to this temperature, and after they were frozen were removed from the molds and taken to the cold-storage warehouse. The plank molds were generally cooled below 32° F. before using. In these tests it was intended to freeze the material as soon as practicable after mixing, and use mixtures as wet as ordinarily employed in construction. Specimens exposed to zero temperature while setting were allowed at least one day in air at about 70° F. immediately before testing.

CEMENTS WHICH SET IN AIR AT DIFFERENT TEMPERATURES.

DETAILS OF COMPRESSION TESTS OF SPECIMENS WHICH WERE EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
☆1 × 1 F 15 ...	Star	1	1	36.1	5	1	2.00	2.05	2.11	4.33	1,410	326	....	
		......	......	......	......	......	2.02	2.11	2.10	4.43	1,120	253	....	
		......	......	......	......	......	2.00	2.06	2.19	4.51	1,280	284	....	
		......	......	......	......	......	2.01	2.01	2.14	4.30	1,220	284	....	
		......	......	......	......	......	2.01	2.09	2.13	4.45	1,290	290	287	
		1	1	36.1	5	7	2.05	2.03	2.12	4.30	3,480	809	....	
		......	......	......	......	......	2.05	2.04	2.14	4.37	3,420	783	....	
		......	......	......	......	......	2.05	1.97	2.07	4.08	3,160	775	....	
		......	......	......	......	......	2.00	2.05	2.12	4.35	4,060	933	....	
		......	......	......	......	......	2.02	2.00	2.14	4.28	4,020	931	816	
☆1 × 1 F 15 ...	Star	1	1	36.1	14	1	2.02	2.04	2.13	4.35	1,390	320	....	
		......	......	......	......	......	2.04	2.02	2.16	4.36	1,390	319	....	
		......	......	......	......	......	2.04	2.01	2.08	4.18	1,320	316	....	
		......	......	......	......	......	2.00	1.98	2.08	4.12	1,360	330	....	
		......	......	......	......	......	2.02	2.06	2.17	4.47	1,430	320	321	
		1	1	36.1	14	7	2.00	2.00	2.08	4.16	4,200	1,010	....	
		......	......	......	......	......	2.00	2.03	2.08	4.22	4,040	957	....	
		......	......	......	......	......	2.08	2.01	2.13	4.28	4,030	941	....	
		......	......	......	......	......	2.03	2.01	2.16	4.34	4,430	1,020	....	
		......	......	......	......	......	2.01	2.01	2.09	4.20	4,520	1,080	1,000	
☆1 × 1 F 15	Star	1	1	36.1	21	1	2.07	2.01	2.18	4.38	1,320	301	....	
		......	......	......	......	......	2.01	2.08	2.13	4.43	1,500	339	....	
		......	......	......	......	......	2.05	2.01	2.17	4.36	1,340	307	....	
		......	......	......	......	......	2.02	2.00	2.06	4.12	1,380	335	....	
		......	......	......	......	......	1.98	2.00	2.08	4.16	1,670	401	337	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
☆1-1 F 15	Star	1	1	36.1	21	7	2.06	2.00	2.14	4.28	4,260	995		
							2.08	1.96	2.11	4.14	4,350	1,050		
							2.00	2.03	2.11	4.28	4,520	1,060		
							2.00	2.03	2.08	4.22	4,270	1,010		
							2.00	2.00	2.10	4.20	3,820	910	1,010	
☆1-1 F 15	Star	1	1	36.1	31	1	2.03	2.06	2.17	4.47	1,920	430		
							1.94	2.03	2.12	4.30	1,700	395		
							2.00	2.05	2.19	4.49	1,740	388		
							2.00	2.01	2.06	4.14	1,660	401		
							2.01	2.01	2.18	4.38	1,320	301	383	
		1	1	36.1	31	7	2.01	1.99	2.08	4.14	4,510	1,090		
							2.01	2.06	2.10	4.33	4,500	1,040		
							2.02	2.01	2.16	4.34	4,020	926		
							2.01	2.00	2.09	4.18	4,010	959		
							2.00	2.00	2.02	4.04	3,600	891	981	
		1	1	36.1	31	30	2.00	2.15	2.02	4.34	5,700	1,310		
							2.02	2.01	2.08	4.18	5,940	1,420		
							2.00	2.07	1.98	4.10	6,490	1,580		
							1.97	2.10	2.05	4.31	5,780	1,340		
							2.03	2.00	2.01	4.02	5,370	1,340	1,400	
☆F 8	**Star**	Neat.		23.4	31	1	2.04	2.02	2.14	4.32	6,250	1,450		
							2.01	2.02	2.11	4.26	6,620	1,550		
							2.08	2.00	2.11	4.22	5,160	1,220		
							2.04	2.14	1.98	4.24	5,130	1,210		
							2.02	2.02	2.12	4.28	5,700	1,330	1,350	
		Neat.		23.4	31	7	2.01	2.00	2.12	4.24	9,820	2,320		
							1.99	2.03	2.09	4.24	10,060	2,370		
							2.00	2.02	2.14	4.32	10,620	2,460		
							2.00	2.07	2.13	4.41	9,680	2,200		
							2.01	2.03	2.15	4.36	10,350	2,370	2,340	

		Neat.		23.4	31	30	2.00	2.01	2.12	4.26	14,600	3,430	
							2.06	2.02	2.10	4.24	12,450	2,940	
							2.01	1.99	2.10	4.18	14,050	3,360	
							2.06	2.00	2.12	4.24	14,260	3,360	
							2.02	1.99	2.17	4.32	14,300	3,310	3,460
☆ 1 - 1 F 15	Star	1	1	36.1	60	1	2.00	2.02	2.10	4.24	1,810	427	
							2.03	2.02	2.15	4.31	1,870	431	
							2.01	2.06	2.15	4.43	1,700	384	
							2.04	2.10	1.97	4.14	1,720	415	
							2.02	2.12	2.08	4.41	1,860	422	416
		1	1	36.1	60	7	2.02	2.04	2.13	4.35	3,150	724	
							2.02	2.15	2.03	4.36	4,600	1,060	
							2.08	2.01	2.14	4.30	4,130	960	
							2.02	2.00	2.09	4.18	4,600	1,100	
							2.03	2.15	2.01	4.32	4,570	1,060	981
		1	1	36.1	60	14	2.01	1.97	2.06	4.06	5,140	1,270	
							2.02	2.03	2.20	4.47	5,010	1,120	
							2.04	2.01	2.12	4.26	5,210	1,220	
							2.07	2.20	2.04	4.49	5,720	1,270	
							2.03	2.02	2.10	4.24	5,730	1,350	1,250
☆ F. 8	Star	Neat.		23.4	89	1	2.04	2.00	2.13	4.26	7,200	1,690	
							2.02	1.99	2.17	4.32	7,550	1,750	
							2.02	2.10	2.23	4.68	8,100	1,730	
							2.02	2.01	2.19	4.40	7,700	1,750	
							2.02	2.03	2.20	4.47	7,610	1,700	1,720
		Neat.		23.4	89	7	2.05	2.13	1.94	4.13	10,450	2,530	
							1.99	2.13	1.91	4.07	12,240	3,010	
							2.04	2.18	2.02	4.40	11,600	2,640	
							2.00	2.20	2.02	4.44	11,570	2,610	
							2.07	2.11	2.03	4.28	11,410	2,670	2,690
		Neat.		23.4	89	14	2.06	2.17	2.00	4.34	14,710	3,390	
							2.03	2.19	1.98	4.34	12,400	2,860	
							2.00	2.15	1.98	4.26	14,520	3,410	
							2.01	2.20	2.00	4.40	14,910	3,390	
							2.04	2.10	1.97	4.14	14,300	3,450	3,300
		Neat.		23.4	89	30	1.98	2.15	2.03	4.36	14,960	3,430	
							2.05	2.14	2.02	4.32	15,500	3,590	
							1.94	2.12	2.02	4.28	13,600	3,190	
							2.00	2.12	2.03	4.30	16,750	3,900	
							2.04	2.12	2.01	4.26	16,900	3,970	3,620
1 - 1 F. 15	Star	1	1	36.1	90	1	2.02	2.12	2.03	4.30	2,200	512	
							2.02	2.08	1.98	4.12	2,210	536	
							2.02	2.10	2.01	4.22	2,030	481	
							2.01	2.10	2.00	4.20	2,130	507	
							2.01	2.08	2.04	4.24	1,900	448	497

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
S. 1-1 F. 15	Star	1	1	36.1	90	7	2.01	2.12	2.06	4.37	4,500	1,030		
							1.91	2.06	2.04	4.20	3,960	943		
							2.00	2.14	2.04	4.37	1,370	1,000		
							2.03	2.08	2.01	4.18	4,500	1,080		
							2.05	2.14	1.99	4.26	4.220	991	1,010	
		1	1	36.1	90	14	2.03	2.05	2.02	4.14	5,400	1,300		
							2.00	2.07	2.00	4.14	5,600	1,350		
							2.00	2.06	1.99	4.10	5,570	1,360		
							1.94	1.99	2.00	3.98	4,600	1,160		
							2.03	2.18	2.01	4.38	5,980	1,370	1,310	
S. K. J. 28	Storm King	Neat.		21.4	30	1	2.00	2.03	2.11	4.28	2,920	682		
							2.00	2.01	2.10	4.22	3,310	784		
							2.01	2.04	2.08	4.24	3,120	736		
							2.03	2.00	2.09	4.18	2,930	701		
							2.02	2.00	2.09	4.18	3,520	842	749	
		Neat.		21.4	30	7	2.05	2.00	2.08	4.16	5,600	1,350		
							2.01	2.02	2.09	4.22	5,420	1,280		
							2.04	1.98	2.07	4.10	5,780	1,410		
							2.00	2.04	2.09	4.26	5,390	1,270		
							2.06	2.00	2.04	4.08	5,010	1,230	1,310	
		Neat.		21.4	30	31	2.04	2.00	2.09	4.18	6,580	1,570		
							2.01	2.00	2.14	4.28	7,100	1,660		
							2.03	2.02	2.13	4.30	7,350	1,710		
							2.02	2.02	2.07	4.18	7,750	1,850		
							2.01	2.06	2.11	4.35	7,020	1,610	1,680	
S. K. J. 28	Storm King	Neat.		21.4	91	1	2.02	2.10	2.01	4.22	3,200	758		
							2.00	2.01	2.10	4.22	2,850	675		
							2.07	2.02	2.05	4.14	2,910	704		
							2.01	1.98	2.08	4.12	2,780	675		
							2.03	2.02	2.04	4.12	2,900	704	703	

		Neat.		24.4	91	7	2.03	2.01	2.10	4.22	5,500	1,300	
							2.00	2.10	2.05	4.31	5,490	1,270	
							2.08	2.05	2.00	4.10	6,300	1,540	
							2.03	2.00	2.07	4.14	4,800	1,160	
							2.05	2.10	1.98	4.16	4,900	1,180	1,290
		Neat.		24.4	91	14	1.93	2.08	2.03	4.22	5,400	1,280	
							2.06	2.09	2.00	4.18	6,100	1,460	
							2.08	2.05	1.98	4.06	6,500	1,600	
							2.00	2.08	2.04	4.24	6,560	1,550	
							2.05	2.07	2.00	4.14	7,310	1,770	1,530
Aln. F. 6	Alsen	Neat.		28.2	30	1	2.05	2.14	2.00	4.28	4,610	1,080	
							2.05	2.04	2.02	4.12	3,820	927	
							2.14	2.05	2.00	4.10	4,220	1,030	
							2.10	2.02	2.04	4.12	4,330	1,050	
							2.11	2.08	1.99	4.14	3,500	845	986
		Neat.		28.2	30	7	2.05	2.05	2.07	4.24	10,100	2,380	
							2.06	2.06	2.01	4.14	10,150	2,450	
							2.08	2.04	2.04	4.16	8,200	1,970	
							2.07	2.05	2.01	4.12	11,490	2,790	
							2.06	2.02	2.09	4.22	10,950	2,590	2,440
		Neat.		28.2	30	14	2.06	2.03	2.03	4.12	12,420	3,010	
							2.07	2.05	1.96	4.02	9,300	2,310	
							2.04	2.02	2.04	4.12	9,300	2,260	
							2.02	2.08	2.00	4.16	11,010	2,650	
							2.04	2.04	2.02	4.12	11,300	2,740	2,590
Aln. F. 6	Alsen	Neat.		28.2	90	1	1.98	2.04	2.10	4.28	3,520	822	
							2.05	2.03	2.04	4.14	5,630	1,360	
							2.04	2.02	2.08	4.20	4,520	1,080	
							2.02	2.04	2.07	4.22	5,900	1,400	
							2.06	2.06	2.03	4.18	5,790	1,390	1,210
		Neat.		28.2	90	7	2.06	2.04	2.05	4.18	10,090	2,410	
							2.05	2.01	2.00	4.02	9,000	2,240	
							2.05	2.06	2.05	4.22	11,022	2,660	
							2.05	2.04	2.06	4.20	8,910	2,120	
							2.02	2.05	2.04	4.18	9,610	2.300	2,350
		Neat.		28.2	90	29	2.00	2.06	2.06	4.24	9,600	2,260	
							2.01	2.05	2.03	4.16	11,780	2,830	
							2.00	2.00	2.08	4.16	8,720	2,100	
							2.01	2.05	2.04	4.18	11,800	2,820	
							2.13	2.02	2.04	4.12	11,760	2,610	2,520

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
J. F. 13	Josson	Neat.		27.3	7	1	2.05	2.07	2.10	4.35	1,490	343		When thawed the material apparently not set very much.
							2.06	1.97	2.08	4.10	1,100	268		
							2.05	2.08	2.09	4.35	1,360	313		
							2.04	2.03	2.12	4.30	1,410	328		
							2.11	2.05	2.09	4.28	1,390	325	315	
		Neat.		27.3	7	7	2.06	2.05	2.06	4.22	5,420	1,280		
							2.05	1.96	2.06	4.04	5,970	1,480		
							2.05	2.10	2.07	4.35	6,620	1,520		
							2.02	2.02	2.08	4.20	6,680	1,590		
							2.05	2.02	2.05	4.14	6,050	1,460	1,470	
		Neat.		27.3	7	14	2.08	2.06	2.05	4.22	7,200	1,710		
							2.13	2.06	2.03	4.18	5,460	1,310		
							2.06	2.07	2.06	4.26	5,820	1,370		
							2.01	2.01	2.07	4.16	5,290	1,270		
							2.04	2.10	2.06	4.33	7,230	1,670	1,470	
J. F. 13	Josson	Neat.		27.3	14	1	2.07	2.07	2.06	4.26	940	221		Material had not set when first thawed out.
							2.04	2.00	2.12	4.24	1,005	237		
							2.01	2.02	2.08	4.20	1,160	276		
							2.01	2.04	2.09	4.26	950	223		
							2.03	2.06	2.04	4.20	830	198	231	
		Neat.		27.3	14	7	2.09	2.05	2.04	4.18	5,020	1,200		
							2.09	2.04	2.06	4.20	5,170	1,230		
							2.01	2.02	2.04	4.12	5,160	1,250		
							2.06	2.02	2.06	4.16	5,110	1,230		
							2.11	2.05	2.06	4.22	5,150	1,220	1,230	
		Neat.		27.3	14	14	2.04	2.06	2.07	4.26	5,010	1,180		
							2.06	2.03	2.13	4.32	6,500	1,530		
							2.05	2.05	2.08	4.26	5,500	1,290		
							2.02	2.02	2.06	4.16	6,220	1,500		
							2.13	2.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

J. F. 13	Josson	Neat.		27.3	21	1	2.07	2.08	2.08	4.33	720	167		When first thawed the material was easily indented. Apparently had not set much.
							2.03	2.09	2.06	4.30	770	179		
							2.06	2.05	2.09	4.28	800	187		
							2.05	2.06	2.11	4.35	860	198		
							2.07	2.08	2.07	4.30	840	195	185	
		Neat.		27.3	21	7	2.01	2.06	2.08	4.28	6,360	1,490		
							2.06	2.05	2.09	4.28	5,340	1,250		
							2.10	2.05	2.06	4.22	5,310	1,260		
							2.02	2.09	2.08	4.35	5,200	1,200		
							2.01	2.02	2.04	4.12	5,410	1,310	1,240	
		Neat.		27.3	21	14	2.04	2.05	2.06	4.22	6,290	1,490		
							2.05	2.06	2.06	4.24	6,510	1,540		
							2.02	2.10	2.06	4.33	6,340	1,460		
							2.01	2.06	2.06	4.21	6,410	1,510		
							2.06	2.12	2.10	4.45	6,520	1,470	1,490	Cracks in specimen before testing.
J. F. 13	Josson	Neat.		27.3	29	1	2.04	2.01	2.10	4.28	1,560	364		
							2.04	2.02	2.05	4.14	1,470	355		
							2.03	2.07	2.05	4.24	1,480	349		
							2.03	2.04	2.07	4.22	1,420	336		
							2.04	2.01	2.06	4.14	1,360	329	347	
		Neat.		27.3	29	7	2.02	2.06	2.04	4.20	7,020	1,670		
							2.07	2.00	2.06	4.12	5,400	1,310		
							2.02	2.00	2.06	4.12	5,620	1,360		
							2.06	2.07	2.06	4.26	6,030	1,420		
							2.06	2.06	2.09	4.30	6,010	1,400	1,430	
		Neat.		27.3	29	14	2.06	2.02	2.03	4.10	7,020	1,710		
							2.02	2.04	2.08	4.24	8,650	2,040		
							2.08	2.02	2.05	4.14	5,150	1,240		
							2.02	2.06	2.07	4.26	6,480	1,520		
							2.01	2.04	2.08	4.24	6,620	1,560	1,610	
J. F. 13	Josson	Neat.		27.3	90	1	2.02	2.08	2.10	4.37	2,800	641		
							2.07	2.02	2.07	4.18	2,710	648		
							2.00	2.00	2.08	4.16	2,120	510		
							2.02	2.07	2.06	4.26	2,960	695		
							2.02	2.07	2.07	4.28	2,670	624	624	
		Neat.		27.3	90	7	2.02	2.10	2.05	4.31	6,200	1,440		
							2.10	2.05	2.10	4.31	6,510	1,510		
							2.02	2.00	2.10	4.20	6,500	1,550		
							2.05	2.06	2.07	4.26	6,880	1,620		
							2.02	2.04	2.05	4.18	6,100	1,460	1,520	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
J. F. 13	Josson	Neat.		27.3	7	1	2.05	2.07	2.10	4.35	1,490	343		When thawed the material apparently not set very much.
							2.06	1.97	2.08	4.10	1,100	268		
							2.05	2.08	2.09	4.35	1,360	313		
							2.04	2.03	2.12	4.30	1,410	328		
							2.11	2.05	2.09	4.28	1,390	325	315	
		Neat.		27.3	7	7	2.06	2.05	2.06	4.22	5,420	1,280		
							2.05	1.96	2.06	4.01	5,970	1,480		
							2.05	2.10	2.07	4.35	6,620	1,520		
							2.02	2.02	2.08	4.20	6,680	1,590		
							2.05	2.02	2.05	4.14	6,050	1,460	1,470	
		Neat.		27.3	7	14	2.08	2.06	2.05	4.22	7,200	1,710		
							2.13	2.06	2.03	4.18	5,460	1,310		
							2.06	2.07	2.06	4.26	5,820	1,370		
							2.01	2.01	2.07	4.16	5,290	1,270		
							2.04	2.10	2.06	4.33	7,230	1,670	1,470	
I. F. 13	Josson	Neat.		27.3	14	1	2.07	2.07	2.06	4.26	940	221		Material had not set when first thawed out.
							2.04	2.09	2.12	4.24	1,005	237		
							2.01	2.02	2.08	4.20	1,160	276		
							2.01	2.04	2.09	4.26	950	223		
							2.03	2.06	2.04	4.20	830	198	231	
		Neat.		27.3	14	7	2.09	2.05	2.04	4.18	5,020	1,200		
							2.09	2.04	2.06	4.20	5,170	1,230		
							2.01	2.02	2.04	4.12	5,160	1,250		
							2.06	2.02	2.06	4.16	5,110	1,230		
							2.11	2.05	2.06	4.22	5,150	1,220	1,230	
		Neat.		27.3	14	14	2.04	2.06	2.07	4.26	5,010	1,180		
							2.06	2.03	2.13	4.32	6,590	1,530		
							2.05	2.05	2.08	4.26	5,500	1,290		
							2.02	2.02	2.06	4.16	6,220	1,500		
							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

J. F. 13	Josson	Neat.		27.3	21	1	2.07	2.08	2.08	4.33	720	167		When first thawed the material was easily indented. Apparently had not set much.
							2.03	2.09	2.06	4.30	770	179		
							2.06	2.05	2.09	4.28	800	187		
							2.05	2.06	2.11	4.35	860	198		
							2.07	2.08	2.07	4.30	840	195	185	
		Neat.		27.3	21	7	2.01	2.06	2.08	4.28	6,360	1,490		
							2.06	2.05	2.09	4.28	5,340	1,250		
							2.10	2.05	2.06	4.22	5,310	1,260		
							2.02	2.09	2.08	4.35	5,200	1,200		
							2.01	2.02	2.04	4.12	5,410	1,310	1,240	
		Neat.		27.3	21	14	2.04	2.05	2.06	4.22	6,290	1,490		
							2.05	2.06	2.06	4.24	6,510	1,540		
							2.02	2.10	2.06	4.33	6,340	1,460		
							2.01	2.06	2.06	4.21	6,410	1,510		
							2.06	2.12	2.10	4.45	6,520	1,470	1,490	Cracks in specimen before testing.
I. F. 13	Josson	Neat.		27.3	29	1	2.04	2.04	2.10	4.28	1,560	364		
							2.04	2.02	2.05	4.14	1,470	355		
							2.03	2.07	2.05	4.24	1,480	349		
							2.03	2.01	2.07	4.22	1,420	336		
							2.04	2.01	2.06	4.14	1,360	329	347	
		Neat.		27.3	29	7	2.02	2.06	2.04	4.20	7,020	1,670		
							2.07	2.00	2.06	4.12	5,400	1,310		
							2.02	2.00	2.06	4.12	5,620	1,360		
							2.06	2.07	2.06	4.26	6,030	1,420		
							2.06	2.06	2.09	4.30	6,010	1,400	1,430	
		Neat.		27.3	29	14	2.06	2.02	2.03	4.10	7,020	1,710		
							2.02	2.04	2.08	4.24	8,650	2,040		
							2.08	2.02	2.05	4.14	5,150	1,240		
							2.02	2.06	2.07	4.26	6,480	1,520		
							2.01	2.04	2.08	4.24	6,620	1,560	1,610	
J. F. 13	Josson	Neat.		27.3	90	1	2.02	2.08	2.10	4.37	2,800	641		
							2.07	2.02	2.07	4.18	2,710	648		
							2.00	2.00	2.08	4.16	2,120	510		
							2.02	2.07	2.06	4.26	2,960	695		
							2.02	2.07	2.07	4.28	2,670	624	624	
		Neat.		27.3	90	7	2.02	2.10	2.05	4.31	6,200	1,440		
							2.10	2.05	2.10	4.31	6,510	1,510		
							2.02	2.00	2.10	4.20	6,500	1,550		
							2.05	2.06	2.07	4.26	6,880	1,620		
							2.02	2.04	2.05	4.18	6,100	1,460	1,520	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
J. F. 13	Josson	Neat.		27.3	7	1	2.05	2.07	2.10	4.35	1,490	343	....	When thawed the material apparently not set very much.
							2.06	1.97	2.08	4.10	1,100	268	....	
							2.05	2.08	2.09	4.35	1,360	313	....	
							2.04	2.03	2.12	4.30	1,410	328	....	
							2.11	2.05	2.09	4.28	1,390	325	315	
		Neat.		27.3	7	7	2.06	2.05	2.06	4.22	5,420	1,280	....	
							2.05	1.96	2.06	4.04	5,970	1,480	....	
							2.05	2.10	2.07	4.35	6,620	1,520	....	
							2.02	2.02	2.08	4.20	6,680	1,590	....	
							2.05	2.02	2.05	4.14	6,050	1,460	1,470	
		Neat.		27.3	7	14	2.08	2.06	2.05	4.22	7,200	1,710	....	
							2.13	2.06	2.03	4.18	5,460	1,310	....	
							2.06	2.07	2.06	4.26	5,820	1,370	....	
							2.01	2.01	2.07	4.16	5,290	1,270	....	
							2.01	2.10	2.06	4.33	7,230	1,670	1,470	
J. F. 13	Josson	Neat.		27.3	14	1	2.07	2.07	2.06	4.26	940	221	....	Material had not set when first thawed out.
							2.04	2.09	2.12	4.24	1,005	237	....	
							2.01	2.02	2.08	4.20	1,160	276	....	
							2.01	2.04	2.09	4.26	950	223	....	
							2.03	2.06	2.04	4.20	830	198	231	
		Neat.		27.3	14	7	2.09	2.05	2.04	4.18	5,020	1,200	....	
							2.09	2.04	2.06	4.20	5,170	1,230	....	
							2.01	2.02	2.04	4.12	5,160	1,250	....	
							2.06	2.02	2.06	4.16	5,110	1,230	....	
							2.11	2.05	2.06	4.22	5,150	1,220	1,230	
		Neat.		27.3	14	14	2.04	2.06	2.07	4.26	5,010	1,180	....	
							2.06	2.03	2.13	4.32	6,590	1,530	....	
							2.05	2.05	2.08	4.26	5,500	1,290	....	
							2.02	2.02	2.06	4.16	6,220	1,500	....	
							2.13	2.08	2.06	4.28	5,600	1,310	1,360	

J. F. 13	Josson	Neat.		27.3	21	1	2.07	2.08	2.08	4.33	720	167		When first thawed the material was easily indented. Apparently had not set much.
							2.03	2.09	2.06	4.30	770	179		
							2.06	2.05	2.09	4.28	800	187		
							2.05	2.06	2.11	4.35	860	198		
							2.07	2.08	2.07	4.30	840	195	185	
		Neat.		27.3	21	7	2.01	2.06	2.08	4.28	6,360	1,490		
							2.06	2.05	2.09	4.28	5,340	1,250		
							2.10	2.05	2.06	4.22	5,310	1,260		
							2.02	2.09	2.08	4.35	5,200	1,200		
							2.01	2.02	2.04	4.12	5,110	1,310	1,240	
		Neat.		27.3	21	14	2.01	2.05	2.06	4.22	6,290	1,490		
							2.05	2.06	2.06	4.24	6,510	1,540		
							2.02	2.10	2.06	4.33	6,340	1,460		
							2.01	2.06	2.06	4.24	6,410	1,510		
							2.06	2.12	2.10	4.45	6,520	1,470	1,490	Cracks in specimen before testing.
J. F. 13	Josson	Neat.		27.3	29	1	2.04	2.01	2.10	4.28	1,560	364		
							2.04	2.02	2.05	4.14	1,470	355		
							2.03	2.07	2.05	4.24	1,480	349		
							2.03	2.04	2.07	4.22	1,420	336		
							2.04	2.01	2.06	4.14	1,360	329	347	
		Neat.		27.3	29	7	2.02	2.06	2.04	4.20	7,020	1,670		
							2.07	2.00	2.06	4.12	5,400	1,310		
							2.02	2.00	2.06	4.12	5,620	1,360		
							2.06	2.07	2.06	4.26	6,030	1,420		
							2.06	2.06	2.09	4.30	6,010	1,400	1,430	
		Neat.		27.3	29	14	2.06	2.02	2.03	4.10	7,020	1,710		
							2.02	2.04	2.08	4.24	8,650	2,040		
							2.08	2.02	2.05	4.14	5,150	1,240		
							2.02	2.06	2.07	4.26	6,480	1,520		
							2.01	2.04	2.08	4.24	6,620	1,560	1,610	
J. F. 13	Josson	Neat.		27.3	90	1	2.02	2.08	2.10	4.37	2,800	641		
							2.07	2.02	2.07	4.18	2,710	648		
							2.00	2.00	2.08	4.16	2,120	510		
							2.02	2.07	2.06	4.26	2,960	695		
							2.02	2.07	2.07	4.28	2,670	624	624	
		Neat.		27.3	90	7	2.02	2.10	2.05	4.31	6,200	1,440		
							2.10	2.05	2.10	4.31	6,510	1,510		
							2.02	2.00	2.10	4.20	6,500	1,550		
							2.05	2.06	2.07	4.26	6,880	1,620		
							2.02	2.04	2.05	4.18	6,100	1,460	1,520	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
J. F. 13	Josson	Neat.		27.3	90	15	1.99	2.02	2.05	4.14	5,270	1,270		
							2.02	2.13	2.03	4.32	8,820	2,040		
							2.02	2.05	2.02	4.14	8,340	2,010		
							2.04	2.02	2.10	4.21	6,600	1,560		
							2.03	2.10	2.00	4.20	7,520	1,790	1,730	
Stl. F. 13	Steel	Neat.		36.2	7	1	1.99	2.03	2.10	4.26	380	89		Opened numerous cracks while thawing. Material had not set much when thawed.
							2.06	2.07	2.05	4.24	320	75		
							2.01	2.02	2.10	4.24	410	97		
							2.00	2.05	2.13	4.37	420	96		
							1.98	2.03	2.12	4.30	380	88	89	
		Neat.		36.2	7	7	2.00	2.08	2.10	4.37	1,740	398		Cubes of this age all were more or less checked, which occurred during thawing.
							2.00	2.05	2.05	4.20	1,530	364		
							2.00	2.00	2.11	4.22	1,670	396		
							2.01	2.01	2.07	4.16	1,380	332		
							2.01	2.01	2.11	4.24	1,510	356	369	
		Neat.		36.2	7	14	2.02	2.08	2.10	4.37	2,400	549		Cracked while thawing out.
							2.07	2.02	2.12	4.28	2,360	551		
							2.01	1.98	2.11	4.18	2,250	538		
							2.04	2.03	2.12	4.30	2,170	505		
							2.02	2.05	2.10	4.30	2,370	551	539	
Stl. F. 13	Steel	Neat.		36.2	14	1	2.01	2.02	2.07	4.18	300	72		Not set much when thawed out.
							2.03	1.98	2.07	4.10	260	63		
							2.02	2.05	2.13	4.37	258	59		
							2.04	2.01	2.16	4.34	310	72		
							2.02	2.07	2.08	4.30	316	74	68	

		Neat.		36.2	14	7	2.03	2.04	2.10	4.28	1,910	446		Cracked while thawing out.
							2.01	2.02	2.08	4.20	1,420	338		
							2.05	2.01	2.09	4.20	1,310	312		
							2.02	2.04	2.12	4.32	1,800	417		
							2.02	2.06	2.10	4.33	1,830	423	387	
		Neat.		36.2	14	14	2.00	2.03	2.12	4.30	2,110	491		
							2.00	3.02	2.12	4.28	2,300	537		Cracked while thawing out.
							2.00	2.01	2.11	4.24	2,400	566	531	Do.
Stl. F. 13	Steel	Neat.		36.2	21	1	2.00	2.02	2.10	4.24	220	52		Cubes opened numerous cracks while thawing. Material soft when first thawed.
							2.08	2.02	2.12	4.28	190	44		
							2.02	2.01	2.08	4.18	270	65		
							2.03	2.02	2.08	4.20	190	45		
							2.02	2.01	2.09	4.26	230	54	52	
		Neat.		36.2	21	7	2.04	2.09	2.10	4.39	1,930	440		
							2.01	2.07	2.14	4.43	1,670	377		
							2.02	2.04	2.17	4.43	1,660	375		
							2.00	2.07	2.16	4.47	1,990	445		
							2.04	2.06	2.08	4.28	1,800	421	412	
		Neat.		36.2	21	14	2.04	2.01	2.10	4.22	2,020	479		
							2.06	2.03	2.11	4.28	2,500	584		
							2.04	2.01	2.14	4.30	2,100	489		
							2.04	1.95	2.06	4.02	2,120	527	520	
Stl. F. 13	Steel	Neat.		36.2	33	1	2.01	2.02	2.09	4.22	910	216		When thawing out this material opened numerous cracks, was soft and plastic, apparently had not set very much. The several original cubes were broken up and retamped into molds. No water was added, the mixture shedding water when tamped on this occasion.
							2.03	2.06	2.08	4.28	920	215		
							2.03	2.04	2.08	4.24	1,100	259		
							2.02	2.10	2.04	4.28	1,080	252		
							2.05	2.02	2.06	4.16	840	202	229	
		Neat.		36.2	33	7	2.01	2.04	2.04	4.16	2,940	707		
							2.01	2.05	2.06	4.22	2,600	616		
							2.02	2.05	2.05	4.20	3,480	829		
							2.03	2.02	2.08	4.20	3,120	743		
							2.00	2.01	2.08	4.18	3,260	780	735	
		Neat.		36.2	33	14	2.03	2.02	2.07	4.18	2,980	713		
							2.03	2.01	2.07	4.16	3,220	774		
							2.04	2.02	2.07	4.18	4,100	981	823	
Stl. F. 13	Steel	Neat.		36.2	90	1	2.03	2.11	2.03	4.28	980	229		
							2.05	2.10	2.03	4.26	1,110	261		
							1.99	2.10	2.02	4.24	1,080	255		
							2.02	2.11	2.03	4.28	990	231		
							2.00	2.16	2.01	4.34	900	207	237	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
Stl. F. 15	Steel	Neat.		36.2	90	7	2.03	1.91	2.08	3.94	2,110	532		
							2.00	2.05	2.12	4.35	2,570	591		
							2.02	2.00	2.06	4.12	1,990	483		
							2.03	2.03	2.12	4.30	2,600	605		
							2.00	2.00	2.15	4.30	2,480	577	558	
		Neat.		36.2	90	15	1.99	2.11	2.02	4.26	2,500	587		
							2.01	2.08	2.01	4.18	2,670	639		
							2.01	2.11	2.03	4.28	2,800	654		
							1.93	2.08	2.02	4.20	2,870	683		
							2.00	2.12	2.03	4.30	2,910	677	648	
Aus. F. 6	Austin	Neat.		36.7	30	1	2.03	2.05	2.14	4.39	1,120	255		
							2.06	2.02	2.07	4.18	1,010	242		
							2.02	2.04	2.06	4.20	890	212		
							2.08	2.02	2.11	4.26	880	207		
							2.01	2.03	2.14	4.34	1,190	274	238	
		Neat.		36.7	30	7	2.04	2.00	2.10	4.20	1,780	424		
							2.01	2.02	2.17	4.38	2,040	466		
							2.00	2.03	2.14	4.34	2,020	465		
							2.06	2.03	2.09	4.24	1,800	425		
							2.04	2.02	2.11	4.26	1,970	462	448	
		Neat.		36.7	30	14	2.03	2.06	2.09	4.30	2,100	488		
							2.02	2.01	2.09	4.20	2,080	495		
							2.08	2.01	2.08	4.18	1,890	452		
							2.04	2.02	2.07	4.18	1,770	423		
							2.02	2.01	2.06	4.20	2,010	479	467	
Aus. F. 6	Austin	Neat.		36.7	91	1	1.97	2.05	2.06	4.22	1,090	258		
							2.08	2.10	2.04	4.28	890	208		
							2.02	2.16	2.05	4.43	1,020	230		Corner gone.
							2.03	2.10	2.02	4.24	1,070	252		
							2.02	2.16	2.01	4.11	1,140	259	211	

		Neat.		36.7	91	7	1.94	2.04	2.05	4.18	1,530	366		
							2.06	2.08	2.05	4.26	1,420	333		
							2.05	2.06	1.94	4.00	1,270	318		Corner gone.
							2.04	2.13	2.03	4.32	1,400	324		
							2.02	2.10	2.09	4.39	1,570	358	340	
		Neat.		36.7	91	14	1.93	2.06	2.04	4.20	2,400	572		
							2.03	2.08	2.10	4.37	2,190	501		
							2.04	1.98	1.99	3.94	1,600	406		Corner gone.
							2.02	2.02	2.06	4.16	2,300	553		
							2.05	2.10	2.01	4.22	1,600	379	482	
B. I. F. 7	Bonneville Improved.	Neat.		38.4	32	1	2.07	2.00	2.08	4.16	1,790	430		
							2.04	1.94	2.10	4.07	1,710	420		
							2.01	2.03	2.08	4.22	1,920	455		
							2.06	2.03	2.11	4.28	1,620	379		
							2.05	2.00	2.14	4.28	1,590	371	411	
		Neat.		38.4	32	7	2.01	2.04	2.14	4.37	3,950	904		
							2.02	2.06	2.12	4.37	4,080	934		
							2.01	2.04	2.10	4.28	4,320	1,010		
							2.00	2.03	2.10	4.26	3,470	815		
							2.04	2.00	2.10	4.20	3,590	851	903	
		Neat.		38.4	32	14	2.02	2.00	2.12	4.24	4,380	1,030		
							2.06	2.01	2.07	4.16	4,500	1,080		
							1.93	2.03	2.10	4.26	4,140	972		
							2.02	2.07	2.09	4.33	4,410	1,020		
							1.98	2.02	2.10	4.24	4,020	948	1,010	
B. I. F. 7	Bonneville Improved.	Neat.		38.4	60	1	2.01	2.06	2.10	4.33	2,150	497		
							2.06	2.01	2.14	4.30	1,720	400		
							2.06	2.01	2.14	4.30	1,860	433		
							2.07	2.00	2.15	4.30	1,940	451		
							2.02	2.05	2.09	4.28	1,920	449	446	
		Neat.		38.4	60	7	2.06	2.02	2.14	4.32	3,960	917		
							2.00	2.04	2.10	4.28	3,690	862		
							2.03	2.03	2.13	4.32	3,800	880		
							2.04	2.04	2.15	4.39	3,780	861		
							2.05	2.02	2.15	4.34	3,000	691	842	
		Neat.		38.4	60	14	2.05	2.01	2.02	4.06	3,610	889		Defective.
							2.02	2.09	2.04	4.26	5,340	1,250		
							2.03	2.02	2.02	4.08	4,810	1,180		
							2.01	2.11	2.05	4.33	4,410	1,020		
							2.02	1.93	2.10	4.05	3,640	899	1,050	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
B. I. F. 7	Bonneville improved.	Neat.		38.4	90	1	2.01	2.13	2.04	4.35	2,070	476		
							2.04	2.11	2.07	4.37	1,850	423		
							2.02	2.11	2.08	4.39	2,200	501		
							2.01	2.10	2.05	4.31	2,210	513	478	
		Neat.		38.4	90	7	2.04	2.08	2.02	4.20	3,100	738		
							2.07	2.14	2.01	4.37	3,710	849		
							2.00	2.12	2.03	4.30	3,420	795		
							2.04	2.12	2.02	4.28	3,720	869	810	
		Neat.		38.4	90	14	2.02	2.10	2.01	4.22	4,040	957		
							2.03	2.10	2.01	4.22	4,200	995		
							2.03	2.12	2.04	4.32	4,400	1,020		
							2.03	2.11	2.04	4.30	4,800	1,120	1,020	
H. F. 11	Hoffman	Neat.		35.7	6	1	2.03	2.06	2.13	4.39	870	198		
							2.03	2.06	2.16	4.45	890	200		
							2.06	2.02	2.06	4.16	720	173		
							2.04	2.03	2.04	4.14	520	125		
							2.00	2.01	2.07	4.16	630	151	169	
		Neat.		35.7	6	7	2.02	1.90	2.05	3.90	1,260	323		Corner gone.
							2.01	2.02	2.04	4.12	1,500	364		
							1.93	2.02	2.06	4.16	1,880	452		
							2.03	2.03	2.04	4.14	1,320	319		
							2.02	2.04	2.05	4.18	1,300	311	354	
		Neat.		35.7	6	14	2.00	1.97	2.14	4.22	2,060	488		
							1.99	2.12	1.99	4.22	1,980	469		
							2.03	2.05	2.15	4.41	2,800	635		
							1.96	2.02	2.14	4.32	2,270	525		
							1.99	2.00	2.15	4.30	2,510	584	540	
H. F. 14	Hoffman	Neat.		35.7	15	1	2.02	2.01	2.04	4.10	810	198		
							2.00	1.98	2.06	4.08	690	169		
							2.04	2.02	2.08	4.20	710	169		
							1.99	1.99	2.15	4.28	650	152		
							2.03	2.00	2.12	4.24	950	224	182	

		Neat.	....	35.7	15	7	2.03	2.03	2.14	4.34	2,390	551	....
		....	....	....	......	......	2.00	2.00	2.11	4.28	1,400	327	....
		....	....	....	......	......	2.05	1.95	2.06	4.02	1,760	438	....
		....	....	....	......	......	2.03	2.00	2.12	4.24	1,970	465	....
		....	....	....	......	......	2.00	2.04	2.15	4.39	2,280	519	460
		Neat.	....	35.7	15	14	2.00	2.00	2.14	4.28	1,800	421	....
		....	....	....	......	......	2.01	2.03	2.08	4.22	2,180	517	....
		....	....	....	......	......	1.99	1.98	2.08	4.12	2,150	522	....
		....	....	....	......	......	1.99	1.99	2.00	3.98	2,070	520	....
		....	....	....	......	......	2.05	2.00	2.01	4.02	2,640	657	527
H. F. H........	Hoffman	Neat.	....	35.7	20	1	2.01	2.08	2.11	4.39	880	200	....
		....	....	....	......	......	2.00	2.01	2.11	4.30	620	142	....
		....	....	....	......	......	2.01	2.04	2.06	4.20	680	162	....
		....	....	....	......	......	2.04	2.01	2.02	4.06	540	133	....
		....	....	....	......	......	2.01	2.03	2.09	4.24	860	203	168
		Neat.	....	35.7	20	7	2.04	2.00	2.03	4.26	2,060	484	....
		....	....	....	......	......	1.95	2.05	2.06	4.22	2,070	491	....
		....	....	....	......	......	2.03	1.99	2.00	3.98	1,120	281	....
		....	....	....	......	......	2.06	2.02	2.01	4.06	1,230	303	....
		....	....	....	......	......	2.00	2.03	2.12	4.30	2,170	505	413
		Neat.	....	35.7	20	14	1.99	2.00	2.07	4.14	2,620	633	....
		....	....	....	......	......	1.96	2.06	1.99	4.10	2,520	615	....
		....	....	....	......	......	2.00	2.02	1.95	3.94	2,270	576	....
		....	....	....	......	......	2.00	2.02	2.02	4.08	2,830	694	....
		....	....	....	......	......	2.04	2.02	2.02	4.08	2,450	600	624
H. F. H........	Hoffman	Neat.	....	35.7	28	1	2.00	1.98	2.05	4.06	920	227	....
		....	....	....	......	......	2.04	2.00	1.97	3.94	880	223	....
		....	....	....	......	......	2.04	2.01	1.98	3.98	910	229	....
		....	....	....	......	......	1.85	2.05	2.06	4.22	760	180	....
		....	....	....	......	......	1.98	2.00	1.95	3.90	660	169	206
		Neat.	....	35.7	28	7	2.02	2.00	2.06	4.12	2,060	500	....
		....	....	....	......	......	2.01	2.02	2.04	4.12	1,700	413	....
		....	....	....	......	......	2.04	2.00	2.00	4.00	1,520	380	....
		....	....	....	......	......	1.99	1.98	2.06	4.08	1,410	346	....
		....	....	....	......	......	2.01	2.00	2.06	4.12	1,620	393	406
		Neat.	....	35.7	28	14	2.00	2.12	2.08	4.41	2,530	574	....
		....	....	....	......	......	1.99	2.00	2.12	4.24	2,100	495	....
		....	....	....	......	......	2.01	2.01	2.11	4.24	2,520	594	....
		....	....	....	......	......	2.02	1.91	2.06	4.00	2,710	678	....
		....	....	....	......	......	2.00	2.02	2.12	4.28	1,980	463	561
H. F. H........	Hoffman	Neat.	....	35.7	91	1	2.02	2.20	2.02	4.44	1,350	304	....
		....	....	....	......	......	2.04	2.14	2.02	4.32	1,190	275	....
		....	....	....	......	......	2.01	2.14	2.00	4.28	1,110	259	....
		....	....	....	......	......	2.06	2.12	2.02	4.28	1,200	280	....
		....	....	....	......	......	2.00	2.14	2.03	4.34	1,130	260	276

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED to 0° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	0° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
H. F. 14	Hoffman	Neat.		35.7	91	7	2.08	2.10	1.93	4.05	2,150	531		
							2.00	2.12	2.02	4.28	1,980	463		
							1.99	2.12	2.04	4.32	2,000	463		
							1.99	2.07	2.00	4.14	1,250	302		
							2.00	2.13	2.04	4.35	2,280	524	457	
		Neat.		35.7	91	14	1.94	2.16	1.99	4.30	2,180	507		
							2.00	2.04	2.02	4.12	2,700	655		
							1.99	2.08	2.10	4.37	2,770	634		
							2.00	2.01	2.10	4.22	2,480	588		
							2.02	2.09	2.02	4.22	2,150	509	579	
N. J. 19	Norton	Neat.		38.0	30	1	2.03	2.08	2.06	4.28	1,520	355		
							2.03	2.06	2.12	4.37	1,320	302		
							2.04	2.05	2.12	4.35	1,390	320		
							2.06	2.05	2.10	4.30	1,520	353		
							2.14	2.04	2.07	4.22	1,580	374	341	
		Neat.		38.0	30	7	2.05	2.05	2.10	4.30	3,090	719		
							2.04	2.03	2.03	4.12	2,710	658		
							2.04	2.06	2.05	4.22	2,640	626		
							2.03	2.04	2.06	4.20	2,890	688		
							2.10	2.04	2.12	4.32	2,620	606	659	
		Neat.		38.0	30	30	2.07	2.04	2.06	4.20	2,310	550		
							2.04	2.02	2.09	4.22	3,680	872		Corner gone.
							2.05	2.02	2.06	4.16	3,460	832		
							2.01	2.04	2.08	4.24	3,860	910		
							2.03	1.98	2.06	4.08	3,610	885	850	
N. J. 19	**Norton**	Neat.		38.0	89	1	2.03	2.02	2.10	4.24	1,700	401		
							2.08	2.02	2.06	4.16	1,550	373		
							2.05	2.08	2.07	4.31	1,560	362		
							2.02	2.06	2.05	4.22	1,200	284		
							2.03	2.04	2.02	4.12	1,310	318	**347**	

O. F. 7	Obelisk	Neat.		38.0	89	7	2.06	2.02	2.05	4.14	1,560	377		Defective.
							2.05	2.03	2.07	4.20	2,590	617		
							2.10	2.05	2.06	4.22	2,870	680		
							2.04	2.10	2.05	4.31	2,050	476		Corner gone.
							2.04	2.10	2.03	4.26	2,720	639	558	
		Neat.		38.0	89	14	2.04	2.10	2.02	4.24	2,900	684		
							2.07	2.05	2.02	4.14	3,650	882		
							2.08	2.04	2.08	4.24	3,870	913		
							2.04	2.10	2.03	4.26	3,710	871		
							2.03	2.10	2.03	4.26	3,450	810	832	
		Neat.		38.6	32	1	2.07	2.04	2.12	4.32	930	215		
							2.06	2.02	2.11	4.26	890	209		
							2.03	2.02	2.11	4.26	1,020	239		
							2.01	2.05	2.14	4.39	970	221		
							2.04	2.03	2.08	4.22	1,020	242	225	
		Neat.		38.6	32	7	2.02	2.02	2.12	4.28	2,420	565		
							2.03	2.03	2.14	4.34	2,610	601		
							2.08	2.01	2.11	4.24	2,550	601		
							2.03	2.03	2.18	4.43	2,300	519		
							2.06	2.01	2.13	4.28	2,250	526	562	
		Neat.		38.6	32	14	2.04	2.00	2.05	4.10	2,570	627		
							2.03	2.01	2.00	4.02	2,680	667		
							2.02	2.01	2.02	4.06	2,350	579		
							2.03	1.93	2.04	3.94	2,200	558		
							2.01	2.06	2.00	4.12	2,520	612	609	
O. F. 7	Obelisk	Neat.		38.6	90	1	2.02	2.07	2.10	4.35	1,210	278		
							2.04	2.03	2.08	4.22	1,230	291		
							2.03	2.08	2.06	4.28	1,170	273		
							2.02	2.07	2.09	4.33	1,220	282		
							1.95	2.04	2.08	4.24	1,050	248	274	
		Neat.		38.6	90	7	1.97	2.12	2.03	4.30	1,990	463		
							1.94	2.05	2.03	4.16	2,150	517		
							2.02	2.07	2.06	4.26	2,170	509		
							2.04	2.13	2.07	4.41	2,320	526		
							2.08	2.18	2.02	4.40	2,480	564	516	
		Neat.		38.6	90	14	2.00	2.06	2.03	4.18	2,670	639		
							2.03	2.12	2.02	4.28	3,120	729		
							2.07	2.09	2.01	4.20	2,720	648		
							2.03	2.12	2.02	4.28	2,890	675		
							2.08	2.08	2.01	4.18	2,830	677	674	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 39° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	39° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
☆ 1 × 1 F. 25	Star	1	1	32.0	15	0	1.99	2.03	2.06	4.18	7,680	1,840		
							1.99	2.01	2.06	4.14	6,610	1,600		
							2.01	2.00	2.07	4.14	6,020	1,450		
							1.99	2.01	2.05	4.12	7,750	1,880		
							2.00	1.98	2.03	4.02	7,180	1,790	1,710	
		1	1	32.0	15	7	2.02	1.98	2.06	4.08	10,400	2,550		
							1.99	1.98	2.05	4.06	9,300	2,290		
							2.00	1.99	2.05	4.08	11,550	2,830		
							1.98	1.99	2.08	4.14	12,120	2,930		
							1.99	1.99	2.04	4.06	11,980	2,950	2,710	
☆ J. 22	Star	Neat.		25.7	29	0	2.02	2.06	2.02	4.16	12,600	3,030		
							2.05	1.99	1.96	3.90	13,950	3,580		
							2.03	2.08	1.98	4.12	12,450	3,020		
							2.00	2.03	1.98	4.02	11,060	2,750		
							2.01	2.05	2.03	4.16	10,500	2,520	2,980	
		Neat.		25.7	29	7	2.06	2.02	2.01	4.06	17,600	4,330		
							2.08	2.02	2.00	4.04	13,400	3,320		
							2.05	1.98	1.98	3.92	13,300	3,390		
							2.01	2.05	2.04	4.18	13,400	3,210		
							2.02	2.02	2.01	4.06	12,280	3,020	3,550	
		Neat.		25.7	29	30	2.06	2.01	2.00	4.02	16,350	4,070		
							2.01	2.02	2.00	4.04	16,020	3,970		
							2.01	2.05	2.03	4.16	17,000	4,090		
							2.03	2.01	1.97	3.96	16,500	4,170		
							1.93	2.03	1.99	4.04	19,050	4,720	4,200	
☆ 1 × 1 F. 25	Star	1	1	32.0	31	0	1.98	1.99	2.06	4.10	9,250	2,260		
							2.04	1.99	2.06	4.10	8,100	1,980		
							2.00	2.00	2.07	4.14	7,420	1,790		
							1.99	2.03	1.60	3.25	6,300	1,940		
							2.00	1.99	2.09	4.16	7,600	1,830	1,960	

☆1×1 F. 25	Star	1	1	32.0	31	7	2.00	1.99	2.05	4.08	11,650	2,860		
							1.99	2.03	2.07	4.20	11,200	2,670		
							1.99	2.00	2.05	4.10	11,130	2,710		
							1.98	2.00	2.09	4.18	10,040	2,400		
							1.98	2.02	2.04	4.12	12,210	2,960	2,720	
		1	1	32.0	31	21	2.00	1.98	2.04	4.04	14,500	3,590		
							2.00	1.98	2.07	4.10	11,000	2,680		Defective.
							1.98	2.00	2.05	4.10	11,250	2,740		
							2.00	1.97	2.06	4.06	12,120	2,990		
							1.99	1.99	2.04	4.06	13,130	3,230	3,050	
		1	1	32.0	60	0	1.99	2.02	2.03	4.10	10,900	2,660		
							1.99	2.02	2.04	4.12	9,200	2,230		
							1.99	2.08	1.98	4.12	8,900	2,160		
							2.00	2.05	1.99	4.08	9,600	2,350		
							1.99	1.98	2.03	4.02	11,560	2,880	2,460	
		1	1	32.0	60	7	2.02	2.02	1.98	4.00	13,450	3,360		
							2.03	2.03	1.98	4.02	13,600	3,380		
							1.98	1.98	2.05	4.06	12,450	3,070		
							1.99	2.01	2.03	4.08	12,990	3,190		
							1.98	2.03	2.00	4.06	13,500	3,330	3,270	
		1	1	32.0	60	14	1.98	2.04	2.00	4.08	13,220	3,240		
							1.98	2.07	2.01	4.16	12,500	3,000		
							1.98	2.07	2.00	4.14	14,370	3,470		
							1.98	2.06	2.01	4.14	13,970	3,370		
							1.99	1.99	2.05	4.08	12,390	3,040	3,220	
☆J. 22	Star	Neat.		25.7	90	0	2.01	2.05	2.02	4.14	14,000	3,380		
							2.06	2.00	1.98	3.96	11,400	2,880		
							2.03	2.03	2.05	4.16	14,550	3,500		
							2.03	2.00	2.02	4.04	15,210	3,760		
							2.12	2.02	2.00	4.04	12,950	3,210	3,350	
		Neat.		25.7	90	7	2.04	2.00	2.02	4.04	13,200	3,270		
							2.04	1.96	1.97	3.86	17,310	4,490		
							2.06	2.02	1.94	3.92	18,000	4,590		
							2.01	2.02	2.05	4.14	16,200	3,910		
							2.02	2.02	2.01	4.06	17,010	4,190	4,090	
		Neat.		25.7	90	14	2.04	1.96	2.00	3.92	18,800	4,800		
							2.07	2.02	2.04	4.12	18,280	4,440		
							2.02	1.97	2.04	4.02	18,500	4,600		
							2.06	2.02	1.97	3.98	15,200	3,820		
							2.04	2.00	2.01	4.02	15,130	3,760	4,280	
S. K. J. 21	Storm King	Neat.		25.0	32	0	2.05	1.99	2.05	4.08	8,020	1,970		
							2.04	2.10	2.05	4.30	7,220	1,680		
							2.05	2.03	2.11	4.28	6,750	1,580		
							2.09	2.05	2.06	4.22	6,530	1,550		
							2.04	2.05	2.08	4.26	5,100	1,200	1,600	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 39° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	39° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
S. K. J. 21	Storm King	Neat.		25.0	32	7	2.04	2.05	2.07	4.24	7,320	1,730		
							2.04	2.04	2.06	4.20	8,490	2,020		
							2.01	2.05	2.08	4.26	7,500	1,760		
							2.06	1.96	2.04	4.00	7,010	1,750		
							2.01	2.07	2.08	4.30	7,490	1,740	1,800	
		Neat.		25.0	32	30	2.02	2.04	2.05	4.18	12,420	2,970		
							2.01	2.02	2.04	4.12	11,960	2,900		
							2.03	2.03	2.05	4.16	9,800	2,360		
							2.04	2.02	2.08	4.20	9,600	2,290		
							2.04	1.99	2.01	4.00	9,790	2,450	2,590	
		Neat.		25.0	90	0	2.03	2.10	2.10	4.41	10,200	2,310		
							2.05	2.03	2.01	4.08	9,500	2,330		
							2.05	1.97	2.02	3.98	9,010	2,260		
							2.02	2.08	2.04	4.24	10,400	2,450		
							2.05	2.08	2.05	4.26	9,190	2,160	2,300	
S. K. J. 24	Storm King	Neat.		25.0	90	7	2.03	2.10	2.07	4.35	10,900	2,510		
							2.04	2.02	2.10	4.24	11,710	2,760		
							2.09	2.03	2.04	4.14	9,500	2,290		
							2.02	2.06	2.08	4.28	11,550	2,700		
							2.03	2.04	2.07	4.22	10,010	2,370	2,530	
		Neat.		25.0	90	30	2.00	2.10	2.10	4.41	11,200	2,540		
							2.09	2.10	2.04	4.28	11,420	2,670		
							2.04	2.10	2.05	4.31	12,800	2,970		
							2.03	2.06	2.05	4.22	11,400	2,700	2,700	
Aln. F. 19	Alsen	Neat.		28.2	21	0	1.99	2.00	2.03	4.06	18,500	4,560		
							2.01	2.00	2.03	4.06	19,200	4,730		
							1.99	1.99	2.02	4.02	19,400	4,830		
							1.98	1.99	2.03	2.04	22,600	5,590		
							1.98	1.99	2.04	4.06	19,600	4,830	4,910	

Aln. F. 19	Alsen	Neat.	28.2	31	0	1.98	2.02	2.02	4.08	22,250	5,450		
						1.99	2.00	2.03	4.06	23,700	5,840		
						2.00	1.99	2.01	4.00	22,010	5,500		
						1.99	2.00	2.01	4.02	18,500	4,600		
						2.00	2.00	2.02	4.01	19,700	4,880	5,250	
		Neat.	28.2	31	7	2.00	1.98	2.02	4.00	23,900	5,980		
						2.00	2.00	2.02	4.01	25,100	6,210		
						2.00	1.99	2.02	4.02	23,750	5,910		
						1.99	2.01	2.02	4.06	23,400	5,770		
						2.00	1.99	2.04	4.06	24,360	6,000	5,970	
		Neat.	28.2	31	31	2.01	1.97	2.00	3.94	25,300	6,420		
						1.98	1.99	2.02	4.02	24,100	6,000		
						1.98	2.00	1.96	3.92	24,900	6,350		Corner gone.
						1.99	2.00	2.01	4.02	25,200	6,270		
						1.99	1.99	1.99	3.96	28,100	7,100	6,430	
Aln. F. 19	Alsen	Neat.	28.2	91	0	1.97	2.00	1.97	3.94	20,800	5,280		
						1.98	1.98	1.97	3.90	25,600	6,560		
						1.98	2.03	1.98	4.02	21,100	5,250		
						2.00	2.00	1.99	3.98	25,400	6,380		
						1.92	2.02	2.03	4.10	24,200	5,900	5,870	
		Neat.	28.2	91	8	1.97	2.01	1.98	3.98	26,000	6,530		
						1.99	2.02	1.98	4.00	29,200	7,300		
						1.98	2.02	2.04	4.12	28,710	6,970		
						1.99	2.06	2.00	4.12	26,400	6,410		
						1.98	2.04	2.00	4.08	25,110	6,150	6,670	
		Neat.	28.2	91	30	1.98	1.98	2.02	4.00	25,500	6,380		
						1.98	1.99	2.00	3.98	27,000	6,780		
						1.99	1.99	2.01	4.00	26,110	6,530		
						1.98	2.00	1.99	3.98	24,580	6,180		
						1.98	1.94	1.99	3.86	23,700	6,140	6,400	
J. F. 20	Josson	Neat.	26.0	28	0	1.99	1.99	2.07	4.12	15,200	3,690		
						2.01	1.99	2.04	4.06	16,650	4,100		
						1.98	1.98	2.06	4.08	18,420	4,510		
						1.99	1.99	2.04	4.06	16,100	3,970		
						2.00	1.98	2.09	4.14	15,400	3,720	4,000	
		Neat.	26.0	30	0	1.98	2.00	2.05	4.10	14,420	8,520		
						2.05	1.95	2.00	3.90	16,010	4,110		
						1.99	1.99	2.04	4.06	18,700	4,610		
						1.98	1.99	2.01	4.00	16,800	4,200		
						1.95	1.98	2.04	4.04	14,600	3,610	4,010	
		Neat.	26.0	30	7	1.99	1.98	2.05	4.06	18,500	4,560		
						1.94	2.02	2.08	4.20	17.600	4,190		
						1.99	2.01	2.00	4.02	25,400	6,320		
						1.96	1.96	2.06	4.04	19,500	4,830		
						1.98	1.97	2.04	4.02	20,580	5.120	5,000	

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 39° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	39° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
J. F. 20	Josson	Neat.	....	26.0	30	13	2.00	1.98	2.08	4.12	20,650	5,010	....	
		....	....	....	....	....	1.99	1.99	2.02	4.02	24,200	6,020	....	
		....	....	....	....	....	1.99	1.96	2.06	4.04	22,300	5,520	....	
		....	....	....	....	....	1.98	1.98	2.06	4.08	19,980	4,900	....	
		....	....	....	....	....	1.96	2.10	2.05	4.31	25,300	5,870	5,460	
		Neat.	....	26.0	43	0	2.05	1.92	2.02	3.88	15,200	3,920	....	
		....	....	....	....	....	1.99	1.98	2.10	4.16	17,700	4,250	....	
		....	....	....	....	....	1.99	1.98	2.06	4.08	18,100	4,440	....	
		....	....	....	....	....	2.00	1.99	2.06	4.10	18,950	4,620	....	
		....	....	....	....	....	1.99	1.99	2.08	4.14	19,300	4,660	4,380	
J. F. 20	Josson	Neat.	....	26.0	90	0	1.99	2.04	2.01	4.10	21,600	5,270	....	
		....	....	....	....	....	1.97	2.02	2.03	4.10	19,000	4,630	....	
		....	....	....	....	....	2.02	2.03	1.97	4.00	21,720	5,430	....	
		....	....	....	....	....	1.98	2.02	1.98	4.00	18,400	4,600	....	
		....	....	....	....	....	2.01	2.05	1.99	4.08	20,200	4,950	4,980	
		Neat.	....	26.0	90	8	1.99	2.01	1.98	3.98	22,440	5,640	....	
		....	....	....	....	....	2.02	2.02	1.94	3.92	23,300	5,940	....	
		....	....	....	....	....	1.97	2.00	2.05	4.10	17,400	4,240	....	
		....	....	....	....	....	1.97	2.06	1.96	4.04	19,380	4,800	....	
		....	....	....	....	....	2.00	2.05	1.97	4.04	17,010	4,210	4,970	
		Neat.	....	26.0	90	14	2.04	2.02	1.98	4.00	22,900	5,730	....	
		....	....	....	....	....	1.99	2.06	1.99	4.10	22,700	5,540	....	
		....	....	....	....	....	2.04	2.01	2.00	4.02	22,880	5,690	....	
		....	....	....	....	....	2.02	2.03	1.94	3.94	23,500	5,970	....	
		....	....	....	....	....	1.99	2.06	1.98	4.08	17,000	4,170	5,420	
Stl. F. 21	Steel	Neat.	....	34.4	15	0	2.00	2.04	1.96	4.00	3,620	905	....	
		....	....	....	....	....	1.96	2.00	2.03	4.06	3,980	980	....	
		....	....	....	....	....	2.00	2.01	2.04	4.10	3,810	930	....	
		....	....	....	....	....	1.97	1.96	2.04	4.00	3,690	923	....	
		....	....	....	....	....	1.98	1.96	2.06	4.08	3,640	892	926	

		Neat.		34.4	15	7	2.00	1.99	2.08	4.14	5,880	1,420	
							2.01	1.98	2.01	3.98	5,600	1,410	
							1.98	1.99	2.07	4.12	6,630	1,610	
							1.99	1.99	2.08	4.11	6,120	1,480	
							1.98	1.99	2.02	4.02	5,910	1,470	1,480
		Neat.		34.4	15	14	1.99	1.96	1.98	3.88	6,220	1,600	
							1.98	1.96	2.03	3.98	6,130	1,540	
							2.08	1.94	2.01	3.90	5,270	1,350	
							1.99	1.99	2.08	4.14	6,040	1,460	
							1.98	1.98	2.05	4.06	5,430	1,340	1,460
Stl. F. 21	Steel	Neat.		34.4	21	0	2.00	1.98	2.05	4.06	4,380	1,080	
							1.99	1.99	2.05	4.08	4,510	1,110	
							2.03	1.94	2.05	3.98	4,160	1,050	
							2.00	1.97	2.08	4.10	4,980	1,210	
							2.04	1.93	2.07	4.00	4,420	1,110	1,110
		Neat.		34.4	21	7	1.98	1.99	2.05	4.08	6,340	1,550	
							1.99	1.97	2.01	3.96	6,110	1,540	
							1.98	1.97	1.98	3.90	5,920	1,520	
							1.99	1.98	2.02	4.00	5,970	1,490	
							1.97	1.99	2.05	4.08	5,580	1,370	1,490
		Neat.		34.4	21	14	1.99	1.98	2.06	4.08	6,150	1,510	
							1.98	2.00	2.02	4.04	5,370	1,330	
							1.98	1.99	2.08	4.14	7,100	1,710	
							1.99	1.99	2.00	3.98	5,300	1,330	
							1.97	1.98	2.04	4.04	6,300	1,560	1,490
Stl. F. 21	Steel	Neat.		34.4	32	0	1.98	1.98	2.09	4.14	5,600	1,350	
							1.98	2.02	2.06	4.16	5,520	1,330	
							1.98	2.00	2.08	4.16	5,520	1,330	
							1.98	1.97	2.06	4.06	5,260	1,300	
							1.98	2.00	2.04	4.08	5,250	1,290	1,320
		Neat.		34.4	32	7	2.02	1.94	2.02	3.92	5,950	1,520	
							1.98	2.01	2.03	4.08	5,910	1,450	
							1.97	1.99	2.04	4.06	6,420	1,580	
							2.00	1.98	2.01	3.98	5,400	1,360	
							1.98	1.96	2.00	3.92	5,160	1,320	1,450
		Neat.		34.4	32	14	1.98	1.98	2.03	4.02	5,480	1,360	
							2.00	1.98	2.08	4.12	6,830	1,660	
							2.04	1.92	2.02	3.88	6,150	1,590	
							2.01	1.92	2.05	4.94	6,300	1,600	
							1.99	1.99	2.10	4.18	6,420	1,540	1,550
Aus. F. 12	Austin	Neat.		37.1	30	0	2.00	1.99	2.08	4.14	3,210	775	
							2.04	1.95	2.09	4.08	3,190	782	
							2.00	2.00	2.10	4.20	3,630	864	
							1.99	2.00	2.12	4.24	3,160	745	
							2.00	1.99	2.12	4.22	3,640	863	806

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 39° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	39° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
Aus. F. 12	Austin	Neat.		37.1	30	7	2.01	2.00	2.08	4.16	3,900	938		
							2.00	1.99	2.15	4.28	4,820	1,130		
							1.99	2.00	2.11	4.22	4,600	1,090		
							1.97	2.05	2.05	4.20	3,550	845		
							1.97	2.00	2.12	4.24	4,720	1,110	1,020	
		Neat.		37.1	30	14	2.00	2.00	2.07	4.14	5,610	1,360		
							2.00	2.00	2.12	4.24	5,770	1,360		
							2.00	2.03	2.10	4.26	5,130	1,200		
							2.00	2.00	2.10	4.20	5,960	1,420		
							2.02	2.00	2.09	4.18	5,880	1,410	1,350	
Aus. F. 12	Austin	Neat.		37.1	91	0	2.00	2.02	2.08	4.20	4,390	1,050		
							2.04	2.04	2.10	4.28	4,210	984		
							2.02	2.02	2.12	4.28	3,800	888		
							2.01	2.02	2.08	4.20	5,200	1,240		
							2.00	2.01	2.12	4.26	4,310	1,010	1,030	
		Neat.		37.1	91	7	2.02	2.01	2.10	4.22	6,640	1,570		
							1.98	2.00	2.10	4.20	5,800	1,380		
							2.04	1.91	2.08	4.04	5,400	1,340		
							1.98	2.03	2.10	4.26	5,120	1,200		
							1.96	2.03	2.08	4.22	5,470	1,300	1,360	
		Neat.		37.1	91	15	2.00	2.12	1.98	4.20	6,000	1,430		
							2.02	2.10	1.99	4.18	6,150	1,470		
							1.99	2.12	2.00	4.24	6,120	1,440		
							1.97	2.14	2.00	4.28	6,540	1,530		
							2.01	2.08	2.00	4.16	6,360	1,530	1,480	
B. I. F. 18	Bonneville Improved.	Neat.		35.9	30	0	2.00	2.01	2.15	4.32	5,100	1,180		
							1.94	2.03	2.09	4.24	4,510	1,060		
							2.00	1.99	2.12	4.22	5,400	1,280		
							1.99	2.00	2.09	4.18	5,250	1,250		
							2.00	1.99	2.15	4.28	5,240	1,220	1,200	

		Neat.		35.9	30	7	2.00	1.98	2.10	4.15	6,530	1,570	
							2.00	2.00	2.10	4.20	7,100	1,690	
							2.00	1.99	2.10	4.18	7,350	1,760	
							2.00	1.99	2.07	4.12	6,740	1,640	
							2.01	2.02	2.08	4.20	6,420	1,530	1,640
		Neat.		35.9	30	14	1.99	1.99	2.12	4.22	7,810	1,850	
							1.97	2.00	2.09	4.18	7,800	1,870	
							2.00	1.98	2.10	4.16	7,200	1,730	
							2.00	2.00	2.10	4.20	8,140	1,940	
							2.00	1.99	2.10	4.18	7,970	1,910	1,860
B. I. F. 18	Bonneville Improved.	Neat.		35.9	61	0	2.07	2.10	1.92	4.03	5,550	1,380	
							2.00	2.00	2.12	4.24	7,010	1,650	
							2.02	2.12	2.00	4.24	6,050	1,420	
							2.00	2.07	2.04	4.22	5,980	1,420	
							1.95	2.12	2.05	4.35	5,500	1,260	1,430
		Neat.		35.9	61	7	1.99	1.99	2.10	4.18	8,600	2,060	
							1.99	2.00	2.09	4.18	8,150	1,950	
							1.99	2.02	2.11	4.26	7,200	1,690	
							1.99	2.00	2.05	4.10	7,380	1,800	
							1.99	2.00	2.08	4.16	7,400	1,780	1,860
		Neat.		35.9	61	14	1.98	1.99	2.10	4.18	8,760	2,100	
							2.00	2.02	2.12	4.28	8,600	2,010	
							2.02	2.10	2.00	4.20	8,150	1,940	
							1.97	2.00	2.10	4.20	8,200	1,950	
							2.08	1.93	2.12	4.09	7,600	1,860	1,970
B. I. F. 18......	Bonneville Improved.	Neat.		35.9	89	2	2.05	2.04	2.02	4.12	5,100	1,240	
							2.00	2.04	2.03	4.14	5,200	1,260	1,250
		Neat.		35.9	89	7	1.96	2.09	2.00	4.18	8,990	2,150	
							2.00	2.17	2.00	4.34	7,300	1,680	
							2.04	2.10	2.00	4.20	7,220	1,720	
							2.00	2.13	2.02	4.30	8,000	1,860	
							1.99	2.13	2.02	4.30	8,600	2,000	1,880
		Neat.		35.9	89	13	2.00	2.12	1.99	4.22	9,050	2,140	
							1.98	2.10	2.02	4.24	9,070	2,140	
							2.00	2.08	1.99	4.14	8,300	2,010	
							2.00	2.10	2.01	4.22	8,900	2,110	
							2.00	2.11	2.00	4.22	8,000	1,900	2,060
H. F. 11	Hoffman	Neat.		35.5	8	0	2.02	2.00	2.13	4.26	2,210	519	
							2.00	2.00	2.10	4.20	2,220	529	
							2.00	2.00	2.06	4.12	2,100	510	
							1.99	1.99	2.08	4.14	2,240	541	
							2.01	2.05	2.04	4.39	2,250	513	522

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 39° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	39° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
H. F. 11	Hoffman	Neat.		35.5	8	7	2.04	1.92	2.05	3.94	3,520	893		
							2.00	2.00	2.15	4.30	3,580	833		
							2.00	2.00	2.09	4.18	3,470	830		
							2.00	2.00	2.13	4.26	3,290	772		
							2.02	2.00	2.05	4.10	3,620	883	842	
		Neat.		35.5	8	14	1.98	2.00	2.06	4.12	4,820	1,170		
							2.00	2.00	2.06	4.12	4,510	1,090		
							2.01	2.00	2.06	4.12	4,290	1,040		
							2.00	2.00	2.07	4.14	5,040	1,220	1,130	
H. F. 11	Hoffman	Neat.		35.5	14	0	2.00	2.00	2.06	4.12	2,580	626		
							2.00	2.01	2.05	4.12	2,540	617		
							2.01	2.01	2.05	4.12	2,820	684		
							2.04	1.98	2.05	4.06	2,710	667		
							2.00	2.01	2.07	4.16	2,700	649	649	
		Neat.		35.5	14	7	1.99	2.00	2.08	4.16	4,320	1,040		
							2.00	1.99	2.08	4.14	3,520	850		
							2.00	2.01	2.11	4.24	3,480	821		
							2.02	2.00	2.12	4.24	4,010	946		
							1.98	2.00	2.13	4.26	3,770	885		
							2.00	2.02	2.08	4.20	3,750	893		
							2.00	2.02	2.06	4.16	3,630	873	901	
H. F. 11	Hoffman	Neat.		35.5	23	0	2.00	2.00	2.13	4.26	3,240	760		
							2.00	2.01	2.09	4.20	2,800	667		
							1.94	2.05	2.07	4.24	3,020	712		
							2.00	2.00	2.06	4.12	3,410	828		
							1.98	2.00	2.08	4.16	3,230	776	549	
		Neat.		35.5	23	7	2.03	1.94	2.10	4.07	4,610	1,130		
							2.00	2.00	2.08	4.16	4,690	1,130		
							1.99	2.00	2.09	4.18	4,850	1,160		
							1.99	2.02	2.06	4.16	4,340	1,040		
							2.01	2.00	2.09	4.18	4,630	1,110	1,110	

H. F. 11	Hoffman	Neat.		35.5	28	0	1.97	2.03	2.06	4.18	3,210	768	
							2.00	2.01	2.14	4.30	3,060	712	
							2.00	2.00	2.10	4.20	3,080	733	
							1.99	2.00	2.05	4.10	3,110	759	
							2.00	2.00	2.05	4.10	3,060	746	744
		Neat.		35.5	28	7	2.02	1.99	2.07	4.12	5,020	1,220	
							1.98	2.00	2.06	4.12	5,030	1,220	
							1.99	2.00	2.06	4.12	4,620	1,120	
							1.96	2.00	2.04	4.08	4,220	1,030	1,120
H. J. 25	Hoffman	Neat.		36.2	31	0	2.04	2.06	2.05	4.22	4,140	981	
							2.06	2.05	2.08	4.26	3,670	861	
							2.05	2.04	2.12	4.32	4,080	944	
							2.00	2.05	2.07	4.24	4,620	1,090	
							2.12	2.05	2.05	4.20	3,710	883	952
		Neat.		36.2	31	7	2.05	2.04	2.06	4.20	3,720	886	
							2.06	2.03	2.10	4.26	4,550	1,070	
							2.04	2.04	2.10	4.28	4,980	1,160	
							1.96	2.05	2.09	4.28	4,630	1,080	
							2.06	1.98	2.06	4.08	4,120	1,010	1,040
		Neat.		36.2	31	30	2.04	2.02	2.06	4.16	5,420	1,300	
							2.04	2.06	2.08	4.28	4,810	1,120	
							2.06	2.03	2.08	4.22	4,610	1,090	1,170
H. J. 25	Hoffman	Neat.		36.2	91	0	2.08	2.08	2.04	4.24	4,320	1,020	
							2.04	2.05	2.08	4.26	4,550	1,070	
							2.03	2.05	2.08	4.26	7,400	1,740	
							2.02	2.10	2.06	4.33	5,230	1,210	
							2.03	2.06	2.08	4.28	6,410	1,500	1,310
		Neat.		36.2	91	7	2.06	2.02	2.09	4.22	5,310	1,260	
							2.03	2.06	2.05	4.22	4,890	1,160	
							2.08	2.04	2.04	4.16	4,700	1,130	
							2.05	2.04	2.06	4.20	4,880	1,140	
							2.03	2.03	2.10	4.26	6,150	1,440	1,230
		Neat.		36.2	91	14	2.05	2.08	2.03	4.22	6,600	1,560	
							2.04	2.04	2.10	4.28	5,610	1,310	
							2.04	2.08	2.08	4.33	6,700	1,550	
							2.04	2.04	2.08	4.24	6,820	1,610	
							1.95	2.08	2.05	4.26	5,550	1,300	1,470
N. J. 21	Norton	Neat.		38.2	30	0	2.03	2.02	2.08	4.20	2,680	638	
							2.03	2.10	2.03	4.26	2,940	690	
							2.02	2.03	2.04	4.14	2,720	657	
							2.02	2.05	2.06	4.22	3,010	713	
							2.08	2.03	2.04	4.14	2,400	580	656

DETAILS OF COMPRESSION TESTS OF SPECIMENS EXPOSED TO 39° F. TEMPERATURE WHILE SETTING, AND SUBSEQUENTLY AT 70° F.—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	39° F.	70° F.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
N. J. 21	Norton	Neat.		38.2	30	7	2.06	2.03	2.05	4.16	2,500	601		
							2.05	2.03	2.05	4.16	3,490	839		
							2.05	2.02	2.05	4.14	3,470	838		
							2.05	2.04	2.06	4.20	3,140	748		
							2.06	2.04	2.08	4.24	3,010	710	747	
		Neat.		38.2	30	30	2.04	2.03	2.01	4.08	5,010	1,230		
							2.04	2.02	2.04	4.12	5,420	1,320		
							2.02	2.03	2.01	4.08	3,840	941		
							2.02	2.05	2.01	4.12	5,500	1,330		
							2.03	2.04	2.00	4.08	4,530	1,110	1,190	
N. J. 21	Norton	Neat.		38.2	91	0	2.04	2.05	2.03	4.16	4,800	1,150		Corner gone.
							2.04	2.02	2.05	4.14	4,710	1,140		
							2.04	2.03	2.00	4.06	5,110	1,260		
							2.02	1.99	2.06	4.10	4,230	1,030		
							2.05	2.07	2.02	4.18	3,900	933	1,100	
		Neat.		38.2	91	7	2.07	2.06	2.02	4.16	4,910	1,180		
							2.04	2.05	2.02	4.14	4,690	1,130		
							2.03	2.06	2.09	4.31	5,010	1,160		
							2.04	2.01	2.10	4.22	5,490	1,300		
							2.01	2.10	2.02	4.24	5,000	1,180	1,190	
		Neat.		38.2	91	14	2.02	2.08	2.00	4.16	5,810	1,400		
							2.00	2.04	2.02	4.12	6,110	1,480		
							2.04	2.08	2.03	4.22	5,700	1,350		
							2.03	2.00	2.10	4.20	6,100	1,450		
							2.05	2.04	2.03	4.14	6,210	1,500	1,440	
O. F. 16	Obelisk	Neat.		36.2	30	0	2.00	1.98	2.03	4.02	4,480	1,110		
							1.98	2.00	2.04	4.08	4,600	1,130		
							2.00	1.97	2.01	3.96	4,740	1,200		
							2.02	1.99	2.04	4.06	4,460	1,100		
							1.99	1.99	2.04	4.06	4,020	990	1,110	

		Neat.		36.2	30	7	2.00	1.99	2.03	4.04	6,640	1,640	
							1.99	1.99	2.03	4.04	6,100	1,510	
							2.00	1.99	2.05	4.08	7,050	1,730	
							1.99	1.99	2.03	4.04	6,550	1,620	
							1.98	2.00	2.03	4.04	6,030	1,490	1,600
		Neat.		36.2	30	14	2.00	2.00	2.04	4.08	7,780	1,910	
							2.00	1.99	2.06	4.10	7,350	1,790	
							2.00	1.98	2.04	4.04	7,760	1,920	
							1.98	1.98	2.04	4.04	6,810	1,690	
							1.98	1.98	2.05	4.06	6,970	1,720	1,810
O. F. 16	Obelisk	Neat.		36.2	91	2	2.00	2.03	1.98	4.02	6,800	1,690	
							1.99	2.04	1.98	4.04	6,870	1,700	
							1.98	2.01	1.98	3.98	7,580	1,900	
							1.96	2.04	1.98	4.04	7,100	1,760	
							1.97	2.02	1.98	4.00	5,800	1,450	1,700
		Neat.		36.2	91	6	2.00	2.04	1.99	4.06	8,210	2,020	
							1.98	2.04	2.01	4.10	9,100	2,220	
							1.98	2.06	1.99	4.10	8,120	1,980	
							1.96	2.01	2.00	4.02	7,610	1,890	
							1.97	2.06	1.99	4.10	7,380	1,800	1,980
		Neat.		36.2	91	13	1.98	2.04	2.00	4.08	10,010	2,450	
							1.98	2.02	1.97	3.98	8,270	2,080	
							1.97	2.03	2.00	4.06	8,200	2,020	
							1.92	2.02	2.00	4.04	7,400	1,830	
							1.98	2.04	1.98	4.04	9,650	2,390	2,150

DETAILS OF COMPRESSION TESTS OF SPECIMENS WHICH WERE EXPOSED TO 70° F. TEMPERATURE ONLY WHILE SETTING.

Marks	Brand of cement.	Composition.			Time of setting in air at temperature of 70° F.	Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.		Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
☆ 1 × 1 F. 25	Star	1	1	32.0	15	2.03	1.98	2.07	4.10	8,220	2,000		
						2.04	2.00	2.04	4.08	8,670	2,130		
						2.00	2.04	2.10	4.28	8,610	2,010		
						2.00	2.04	2.09	4.26	8,040	1,890		
						2.00	2.02	2.12	4.28	7,830	1,830	1,970	
		1	1	32.0	22	2.06	2.01	2.10	4.22	10,300	2,440		
						2.00	2.03	2.08	4.22	9,020	2,140		
						2.00	2.04	2.12	4.32	9,250	2,140		
						2.00	2.04	2.12	4.32	9,310	2,160		
						2.00	2.03	2.08	4.22	10,740	2,550	2,290	
☆ F. 8	Star	Neat.		23.4	29	2.00	1.96	2.04	4.00	18,400	4,600		
						1.98	1.99	2.02	4.02	18,450	4,590		
						1.96	1.98	2.04	4.04	16,020	3,970		
						1.96	1.99	2.01	4.00	17,520	4,380		
						2.00	1.98	2.00	3.96	16,680	4,210	4,350	
☆ 1 × 1 F. 25	Star	1	1	32.0	31	2.00	2.04	2.08	4.24	10,520	2,480		
						2.02	1.99	2.14	4.30	9,610	2,230		
						2.00	2.02	2.09	4.22	10,300	2,440		
						2.04	2.02	2.06	4.16	8,760	2,110		
						2.01	2.04	2.05	4.18	9,950	2,380	2,330	
☆ F. 8	Star	Neat.		23.4	32	1.98	1.98	2.02	4.00	18,500	4,630		
						1.99	1.99	2.02	4.02	19,980	4,970		
						1.98	1.99	2.04	4.06	18,030	4,440		
						1.97	2.00	2.09	4.18	18,420	4,410		
						1.99	1.99	2.03	4.04	17,700	4,380	4,570	
		Neat.		23.4	36	1.96	1.98	2.03	4.02	18,280	4,550		
						1.94	1.99	2.01	4.00	16,100	4,030		
						1.97	1.98	2.01	3.98	16,610	4,170		
						1.96	1.99	2.02	4.02	19,250	4,790		
						1.98	1.97	2.04	4.02	18,980	4,720	4,450	

		Neat.		23.4	38	1.98	1.99	2.05	4.08	19,450	4,770	
						1.99	2.00	2.00	4.00	19,300	4,830	
						1.98	1.98	2.01	3.98	19,960	5,020	
						1.97	1.98	2.01	3.98	18,550	4,660	
						1.99	1.94	2.05	3.98	19,200	4,820	4,820
☆ 1 × 1 F. 25	Star	1	1	32.0	38	2.04	2.00	2.13	4.26	9,620	2,260	
						2.01	2.00	2.12	4.24	9,350	2,210	
						2.02	2.01	2.09	4.20	9,260	2,200,	
						2.00	2.03	2.09	4.24	10,700	2,520	
						2.04	2.01	2.08	4.18	10,100	2,420	2,320
☆ F. 8	Star	Neat.		23.4	59	1.96	1.98	2.13	4.02	19,400	4,830	
						1.96	1.98	2.02	4.00	19,300	4,830	
						1.98	1.99	2.01	4.02	20,450	5,090	
						1.99	1.98	2.02	4.00	18,200	4,550	
						1.97	1.98	2.00	3.96	19,450	4,910	4,840
☆ 1 × 1 F 25	Star	1	1	32.0	60	2.05	2.10	2.01	4.22	10,500	2,490	
						2.00	2.02	2.12	4.28	9,520	2,220	
						2.05	2.04	2.01	4.10	10,920	2,660	
						2.00	2.10	2.04	4.28	10,850	2,540	
						2.02	2.08	2.02	4.20	10,650	2,540	2,490
☆ F 8	Star	Neat.		23.4	61	1.98	1.95	2.08	4.06	18,700	4,610	
						1.98	1.97	2.03	4.00	19,400	4,850	
						1.98	1.98	2.01	3.98	19,720	4,950	
						1.98	1.99	2.01	3.98	19,100	4,800	
						1.97	1.99	2.07	4.12	20,400	4,950	4,830
		Neat.		23.4	104	1.96	2.02	1.97	3.98	15,600	3,920	
						1.97	2.02	1.96	3.96	20,220	5,110	
						1.97	2.02	1.99	4.02	17,700	4,400	
						1.95	2.00	1.97	3.94	17,000	4,310	
						1.96	2.02	1.97	3.98	17,090	4,290	4,410
		Neat.		24.6	120	2.05	2.06	2.00	4.12	15,250	3,700	
						2.02	2.04	1.98	4.02	17,000	4,230	
						2.02	2.08	2.00	4.16	16,800	4,040	
						2.00	2.03	2.06	4.18	17,500	4,190	
						2.01	2.00	2.05	4.10	17,800	4,340	4,100
S. K. F. 4	Storm King	Neat.		25.0	32	1.94	2.02	2.04	4.12	10,100	2,450	
						2.00	2.01	2.08	4.18	10,120	2,420	
						2.01	2.01	2.03	4.08	10,550	2,590	
						2.07	2.02	2.04	4.12	10,380	2,520	
						2.00	2.05	2.05	4.20	10,920	2,600	2,520
		Neat.		25.0	39	2.04	2.00	2.03	4.06	10,150	2,500	
						2.02	1.99	2.08	4.14	12,100	2,920	
						2.01	2.00	2.06	4.12	10,250	2,490	
						2.03	2.01	2.00	4.02	9,520	2,370	
						2.05	2.00	2.03	4.06	10,180	2,510	2,560

DETAILS OF COMPRESSION TESTS OF SPECIMENS WHICH WERE EXPOSED TO 70° F. TEMPERATURE ONLY WHILE SETTING—**Continued.**

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of 70° F.	Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.		Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
S. K. F. 4	Storm King	Neat.		25.0	63	2.01	2.04	2.02	4.12	11,020	2,670		
						2.07	2.01	2.02	4.06	9,100	2,240		
						2.01	2.01	2.11	4.22	10,389	2,460		
						2.02	2.01	2.07	4.16	10,460	2,510		
						2.11	2.02	2.06	4.16	11,020	2,650	2,510	
		Neat.		25.0	91	2.05	2.05	2.00	4.10	10,300	2,510		
						2.03	2.05	2.10	4.31	9,100	2,110		
						2.02	1.92	2.10	4.03	9,210	2,290		
						2.03	1.99	2.06	4.10	10,910	2,660		
						2.02	2.01	2.03	4.08	10,520	2,580	2,430	
		Neat.		25.0	98	2.06	2.02	2.05	4.14	9,500	2,290		
						2.02	2.01	2.08	4.18	9,750	2,340		
						1.92	2.02	2.06	4.16	10,990	2,640		
						2.02	2.02	2.04	4.12	10,200	2,480		
						2.02	2.02	2.06	4.16	10,750	2,580	2,470	
		Neat.		25.0	120	2.02	2.04	2.05	4.18	8,280	1,980		
						2.02	2.10	2.03	4.26	9,900	2,320		
						2.00	2.06	2.04	4.20	10,800	2,570		
						2.01	2.09	2.00	4.18	10,250	2,450		
						2.04	1.96	2.02	3.96	10,200	2,580	2,380	
Aln. F. 19	Alsen	Neat.		28.2	14	2.03	2.00	2.07	4.14	14,600	3,530		
						2.02	2.00	2.06	4.12	15,980	3,880		
						2.03	2.05	2.09	4.28	16,800	3,930		
						2.00	2.05	2.04	4.18	17,300	4,140		
						2.04	2.01	2.06	4.14	14,100	3,410	3,780	
		Neat.		28.2	21	2.00	2.02	2.07	4.18	15,150	3,620		
						2.03	2.00	2.05	4.10	14,320	3,490		
						2.01	2.02	2.04	4.12	18,350	4,450		
						2.06	2.01	2.06	4.14	16,020	3,870		
						2.01	2.05	2.05	4.20	17,700	4,210	3,930	

Aln. F. 19	Alsen	Neat.		28.2	31	2.08	2.00	2.02	4.04	17,380	4,300	
						2.00	2.00	2.08	4.16	16,620	4,000	
						2.02	2.00	2.08	4.16	13,750	3,310	
						2.02	1.99	2.08	4.11	16,100	3,890	
						2.00	2.00	2.12	4.24	16,980	4,000	3,900
		Neat.		28.2	38	2.03	2.01	2.08	4.18	15,500	3,710	
						2.00	2.05	2.04	4.18	12,960	3,100	
						2.02	2.02	2.09	4.22	14,200	3,300	
						2.06	1.99	2.06	4.10	13,400	3,270	
						2.00	2.06	2.05	4.22	16,050	3,800	3,450
		Neat.		28.2	62	1.99	2.09	2.02	4.22	14,020	3,320	
						2.00	2.08	2.00	4.16	13,800	3,320	
						2.00	2.06	2.02	4.16	14,100	3,390	
						2.01	2.00	2.04	4.08	15,100	3,700	
						2.01	2.08	1.98	4.12	14,190	3,440	3,430
		Neat.		28.2	91	2.02	2.07	2.01	4.16	15,370	3,700	
						2.00	2.04	2.07	4.22	18,600	4,410	
						2.02	2.04	2.03	4.14	16,550	4,000	
						2.04	2.05	1.99	4.08	15,700	3,850	
						2.02	2.08	2.02	4.20	17,780	4,230	4,040
		Neat.		28.2	99	2.00	2.04	2.10	4.28	11,500	2,690	
						1.99	2.03	2.04	4.11	14,180	3,430	
						1.98	2.03	3.03	4.12	14,100	3,420	
						2.04	2.00	2.06	4.12	13,520	3,280	
						2.02	2.01	2.08	4.18	12,000	2,870	3,160
		Neat.		28.2	121	2.07	2.00	2.03	4.06	14,000	3,450	
						2.03	1.99	2.07	4.12	14,180	3,440	
						2.02	1.99	2.04	4.06	14,900	3,670	
						2.01	1.99	2.05	4.08	14,100	3,460	3,510
J. F. 20	Josson	Neat.		26.0	14	2.00	2.04	2.04	4.16	13,200	3,170	
						2.00	2.05	2.04	4.18	14,220	3,400	
						2.08	2.00	2.04	4.08	13,100	3,210	
						2.04	2.00	2.03	4.06	13,750	3,390	
						2.02	2.00	2.03	4.06	14,200	3,500	3,330
		Neat.		26.0	21	2.01	2.00	2.01	4.02	13,750	3,420	
						2.02	1.98	2.08	4.12	15,300	3,710	
						2.00	2.02	2.03	4.10	16,030	3,910	
						1.99	2.00	2.04	4.08	15,220	3,730	
						2.01	2.00	2.10	4.20	13,710	3,260	3,610
		Neat.		26.0	28	2.01	1.99	2.03	4.04	17,300	4,280	
						2.03	1.99	2.03	4.04	15,960	3,950	
						1.98	2.01	2.03	4.08	18,150	4,450	
						2.00	2.01	2.08	4.18	13,100	3,130	
						1.98	2.00	2.03	4.06	16,350	4,030	3,970

DETAILS OF COMPRESSION TESTS OF SPECIMENS WHICH WERE EXPOSED TO 70° F. TEMPERATURE ONLY WHILE SETTING—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of 70° F.	Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.		Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
J. F. 20	Josson	Neat.		26.0	30	2.03	2.01	2.05	4.12	12,250	2,970		
						2.01	1.98	2.03	4.02	16,700	4,150		
						2.00	1.99	2.04	4.06	16,350	4,030		
						2.03	1.98	2.02	4.00	13,900	3,480		
						1.97	2.02	2.01	4.06	16,300	4,010	3,730	
		Neat.		26.0	35	1.99	2.03	2.02	4.10	17,900	4,370		
						2.00	2.01	2.06	4.14	12,320	2,980		Corners gone.
						1.99	2.03	2.04	4.14	10,900	2,630		Do.
						2.00	1.98	2.02	4.00	12,050	3,010		
						2.00	2.01	2.00	4.06	13,100	3,230	3,240	
		Neat.		26.0	37	2.02	1.98	2.05	4.06	13,150	3,240		
						2.00	2.00	2.07	4.14	11,980	2,890		
						2.00	1.99	2.05	4.08	14,020	3,440		
						1.99	2.02	2.02	4.08	14,100	3,460		
						2.01	2.00	2.02	4.04	15,400	3,810	3,370	
		Neat.		26.0	43	2.03	1.98	2.03	4.02	16,400	4,080		
						2.01	1.99	2.04	4.06	9,800	2,410		
						1.99	2.09	2.00	4.18	13,100	3,130		
						2.02	1.98	2.06	4.08	13,350	3,270		
						2.00	2.01	2.03	4.08	15,700	3,850	3,350	
		Neat.		26.0	90	1.97	2.03	2.03	4.12	14,950	3,630		
						1.98	2.00	2.08	4.16	13,640	3,280		
						2.03	1.99	2.03	4.04	10,700	2,650	3,110	
Stl. F. 21	Steel	Neat.		34.4	15	2.00	2.02	2.04	4.12	4,530	1,100		
						2.03	2.02	2.04	4.12	4,680	1,140		
						2.03	1.99	2.05	4.08	4,250	1,040		
						2.06	2.01	2.04	4.10	5,280	1,290		
						2.01	1.99	2.06	4.10	4,970	1,120	1,160	
		Neat.		34.4	21	2.02	1.98	2.06	4.08	5,580	1,370		
						1.98	2.01	2.06	4.14	5,070	1,220		
						1.99	2.01	2.09	4.20	4,960	1,180		
						2.03	1.98	2.06	4.08	5,020	1,230		
						1.99	2.01	2.07	4.16	5,060	1,220	1,240	

		Neat.		31.4	28	2.00	1.99	2.07	4.12	5,890	1,430	
						1.98	2.01	2.05	4.18	5,010	1,200	
						2.02	1.98	2.08	4.12	5,310	1,290	
						2.02	2.07	2.06	4.26	5,660	1,330	
						1.98	2.00	2.09	4.18	5,360	1,280	1,310
		Neat.		31.4	32	1.98	2.00	2.03	4.06	4,240	1,040	
						2.01	1.98	2.07	4.10	5,460	1,330	
						2.02	1.98	2.05	4.06	5,720	1,410	
						2.02	2.01	2.06	4.11	4,900	1,180	
						1.99	2.00	2.05	4.10	4,340	1,060	1,200
		Neat.		31.4	35	1.99	2.02	2.03	4.10	4,660	1,140	
						2.04	1.98	2.04	4.04	5,500	1,360	
						2.02	2.00	2.02	4.04	4,560	1,130	
						1.99	2.00	2.04	4.08	5,050	1,240	
						2.00	1.97	2.06	4.06	5,630	1,390	1,250
		Neat.		31.4	39	2.01	1.99	2.07	4.12	5,120	1,240	
						2.04	1.99	2.06	4.10	4,720	1,150	
						2.01	1.98	2.02	4.00	5,100	1,280	
						2.00	2.00	2.04	4.08	4,980	1,220	
						2.01	2.00	2.04	4.08	5,030	1,230	1,220
		Neat.		31.4	46	2.00	1.98	2.06	4.08	6,510	1,600	
						2.00	2.02	2.04	4.12	5,520	1,340	
						2.00	2.00	2.03	4.06	5,530	1,360	
						2.04	1.99	2.09	4.16	6,120	1,470	
						1.99	2.00	2.06	4.12	5,200	1,260	1,410
Aus. F 12	Austin	Neat.		37.1	30	2.08	2.02	2.07	4.18	2,840	679	
						2.03	2.02	2.12	4.28	2,620	612	
						2.01	2.03	2.09	4.24	3,610	851	
						2.03	2.00	2.11	4.22	3,160	749	
						2.04	2.00	2.09	4.18	3,040	727	724
		Neat.		37.1	37	2.07	2.03	2.08	4.22	2,750	652	
						2.01	2.04	2.09	4.26	3,310	777	
						2.04	2.01	2.10	4.22	3,050	723	
						2.05	2.03	2.10	4.26	3,020	709	
						2.07	2.00	2.08	4.16	3,280	788	730
		Neat.		37.1	44	2.02	2.06	2.09	4.30	3,020	702	
						2.01	2.02	2.12	4.28	2,940	687	
						2.02	2.02	2.13	4.30	3,220	749	
						2.05	2.03	2.09	4.24	3,640	859	
						2.02	2.11	2.10	4.43	3,380	763	752
		Neat.		37.1	91	2.02	2.03	2.12	4.30	3,100	721	
						2.04	2.05	2.10	4.31	2,610	607	
						2.03	2.02	2.08	4.20	2,650	631	
						2.02	2.02	2.10	4.24	2,980	703	
						2.02	2.01	2.14	4.30	2,770	644	661

DETAILS OF COMPRESSION TESTS OF SPECIMENS WHICH WERE EXPOSED TO 70° F. TEMPERATURE ONLY WHILE SETTING—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of 70° F.	Dimensions.				Ultimate strength.			Remarks
		Cement.	Sand.	Water.		Height.	Compressed surface.		Sectional area.	Total.	Per square inch.	Mean.	
				Per cent.	Days.	Inches.	Inches.	Inches.	Sq. inches.	Pounds.	Pounds.	Pounds.	
Aus. F 12	Austin	Neat.		37.1	98	2.02	2.12	2.04	4.32	2,600	602		
						2.05	2.09	2.00	4.18	2,590	620		
						1.99	2.13	2.02	4.30	2,700	628		
						2.01	2.08	2.03	4.22	2,900	687		
						2.05	2.10	2.02	4.24	2,800	660	639	
		Neat.		37.1	105	2.02	2.10	2.06	4.33	2,700	623		
						2.02	2.09	2.03	4.24	2,320	547		
						2.03	2.11	2.02	4.26	2,390	561		
						2.00	2.14	2.05	4.39	2,650	604		
						2.04	2.10	2.07	4.35	2,450	563	580	
B. I. F. 18	Bonneville Improved.	Neat.		35.9	15	2.04	2.01	2.05	4.12	4,100	995		
						2.00	2.04	2.11	4.30	2,900	674		
						2.00	2.01	2.11	4.24	3,360	792		
						2.00	2.06	2.10	4.33	3,290	760		
						2.00	2.02	2.10	4.24	3,300	778	800	
		Neat.		35.9	30	2.02	1.99	2.17	4.32	4,100	949		
						2.01	2.00	2.17	4.34	3,520	811		
						2.01	2.01	2.04	4.10	4,900	1,200		
						2.01	2.03	2.08	4.22	5,840	1,380		
						2.00	2.01	2.06	4.14	5,710	1,380	1,140	
		Neat.		35.9	37	2.00	2.03	2.11	4.28	4,620	1,080		
						2.00	2.04	2.04	4.16	5,630	1,350		
						2.02	2.00	2.14	4.28	4,080	953		
						2.04	2.00	2.04	4.08	5,610	1,380		
						2.00	2.06	2.02	4.16	6,050	1,450	1,250	
		Neat.		35.9	44	2.00	2.04	2.07	4.22	5,980	1,420		
						2.00	1.99	1.99	3.96	3,640	919		
						1.99	2.00	2.11	4.22	3,730	884		
						2.05	2.01	2.06	4.14	5,970	1,440		
						2.02	2.00	2.05	4.10	5,520	1,350	1,200	

		Neat.	35.9	61	2.00	2.09	2.08	4.35	4,100	943		
					2.02	1.99	2.08	4.14	5,600	1,350		
					2.06	2.00	2.12	4.24	1,310	1,020		
					2.05	1.98	2.08	4.12	5,700	1,380		
					2.01	2.00	2.07	4.14	5,300	1,280	1,190	
		Neat.	35.9	68	1.99	2.08	2.05	4.26	3,410	801		
					2.00	2.00	2.11	4.26	2,990	702		Defective.
					1.99	1.99	2.15	4.28	3,790	885		
					2.00	2.05	2.05	4.20	4,200	1,000		
					2.02	2.00	2.08	4.16	6,100	1,540	986	
		Neat.	35.9	75	1.99	2.10	2.00	4.20	3,980	948		
					2.05	2.03	2.00	4.06	1,500	1,110		
					2.00	2.02	2.04	4.12	4,700	1,140		
					2.00	1.99	2.05	4.08	5,200	1,270		
					2.00	1.98	2.13	4.22	3,700	877	1,070	
		Neat.	35.9	91	1.99	2.08	2.02	4.20	7,900	1,880		
					2.03	2.10	1.96	4.12	6,500	1,580		
					1.96	2.09	2.07	4.33	6,920	1,600		
					1.99	2.12	2.01	4.26	7,750	1,820	1,720	
H. F. H.	Hoffman	Neat.	35.5	8	2.04	2.03	2.13	4.32	2,680	662		
					2.01	2.02	2.12	4.28	2,430	568		
					2.00	2.03	2.12	4.30	2,690	626		
					2.03	2.05	2.12	4.35	2,930	674		
					2.03	2.03	2.11	4.28	2,620	612	628	
		Neat.	35.5	15	2.01	2.05	2.09	4.28	3,280	766		
					2.02	2.05	2.08	4.26	3,670	861		
					2.02	2.05	2.09	4.28	3,250	759		
					2.03	2.02	2.12	4.30	3,490	812		
					2.03	2.06	2.12	4.37	3,690	844	808	
		Neat.	35.5	23	2.00	2.04	2.10	4.28	4,330	1,010		
					2.06	2.02	2.07	4.18	4,150	993		
					2.02	2.03	2.06	4.18	4,220	1,010		
					2.01	2.08	2.08	4.33	4,040	933		
					2.06	2.00	2.11	4.22	4,030	955	980	
		Neat.	35.5	30	2.02	2.02	2.07	4.18	4,770	1,140		
					2.03	2.00	2.10	4.20	4,980	1,190		
					2.05	2.02	2.08	4.20	4,520	1,080		
					2.00	2.03	2.10	4.26	4,980	1,170		
					2.01	2.07	2.11	4.43	5,000	1,130	1,140	
		Neat.	35.5	35	2.08	2.02	2.06	4.16	4,070	978		
					2.00	2.06	2.09	4.30	5,390	1,250		
					2.01	2.06	2.12	4.37	5,660	1,270		
					2.01	2.01	2.12	4.26	6,100	1,430		
					2.02	2.04	2.12	4.32	4,010	928	1,170	

DETAILS OF COMPRESSION TESTS OF SPECIMENS WHICH WERE EXPOSED TO 70° F. TEMPERATURE ONLY WHILE SETTING—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in air at temperature of 70° F.	Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.		Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
H. F. 11	Hoffman	Neat.		35.5	91	2.00	2.12	2.08	4.41	4,950	1,120		
						2.02	2.08	2.05	4.26	5,100	1,200		
						2.02	2.10	2.02	4.24	4,300	1,010		
						2.01	2.10	2.09	4.39	5,290	1,200		
						2.02	2.09	2.02	4.22	3,500	829	1,070	
		Neat.		35.5	98	2.01	2.10	2.03	4.26	6,200	1,460		
						2.00	2.09	2.02	4.22	5,600	1,330		
						2.00	2.10	2.03	4.26	5,420	1,270		
						2.04	2.08	2.00	4.16	4,500	1,080		
						2.05	2.11	2.00	4.22	5,120	1,210	1,270	
		Neat.		35.5	106	2.01	2.08	2.05	4.26	4,610	1,080		
						2.02	2.10	2.04	4.28	5,420	1,270		
						2.02	2.08	2.04	4.24	3,650	861		
						2.04	2.09	2.00	4.18	4,730	1,130	1,090	
N. F. 23	Norton	Neat.		37.9	14	2.06	2.02	2.09	4.22	2,780	659		
						2.05	2.01	2.08	4.18	2,750	658		
						2.00	2.09	2.10	4.39	3,100	706		
						2.00	2.02	2.11	4.26	3,710	871		
						2.00	1.99	2.08	4.14	3,420	826	744	
		Neat.		37.9	23	2.04	2.01	2.15	4.32	4,300	995		
						1.97	2.00	2.09	4.18	3,410	816		
						2.03	1.98	2.07	4.10	3,450	841		
						2.00	2.03	2.12	4.30	4,010	933		
						2.02	2.02	2.13	4.30	4,110	956	908	
		Neat.		37.9	37	2.02	2.00	2.12	4.24	4,760	1,120		
						2.01	2.02	2.10	4.24	3,460	816		
						1.99	2.00	2.13	4.26	4,740	1,110		
						2.00	2.06	2.10	4.33	4,420	1,020		
						2.02	1.98	2.10	4.16	4,750	1,140	1,040	
		Neat.		37.9	60	2.03	2.02	2.12	4.28	4,410	1,030		
						1.98	1.97	2.14	4.22	4,450	1,060		
						1.99	2.01	2.12	4.26	3,800	892		
						2.02	2.04	2.08	4.24	4,390	1,040		
						2.01	2.01	2.12	4.26	4,750	1,120	1,0[illegible]0	

O. F. 16	Obelisk	Neat.		37.9	90	2.00	2.13	1.98	4.22	4,400	1,040	
						2.03	2.16	2.00	4.32	4,500	1,040	
						1.98	2.13	2.02	4.30	5,670	1,320	
						2.00	2.16	1.99	4.30	4,550	1,060	
						2.02	2.12	2.01	4.26	4,140	972	1,090
		Neat.		37.9	97	1.98	2.10	2.05	4.31	3,600	835	
						1.97	2.13	1.98	4.22	3,190	756	
						1.98	2.12	2.02	4.28	4,300	1,000	
						2.02	2.14	1.99	4.26	4,390	1,030	
						1.93	2.14	1.99	4.26	4,250	998	924
		Neat		37.9	121	1.97	2.02	2.12	4.28	4,910	1,150	
						2.03	2.10	1.98	4.16	3,000	721	
						2.01	2.00	2.08	4.16	3,450	829	
						2.02	2.01	2.10	4.22	4,900	1,160	
						1.97	2.01	2.12	4.26	3,800	892	950
		Neat.		36.2	30	2.02	2.00	2.03	4.06	5,800	1,430	
						2.01	2.00	2.08	4.16	6,520	1,570	
						2.03	1.99	2.02	4.02	6,550	1,630	
						2.01	2.04	2.01	4.10	6,410	1,560	
						2.01	2.00	2.07	4.14	6,580	1,590	1,560
		Neat.		36.2	37	2.04	1.99	2.13	4.24	5,020	1,180	
						2.00	2.01	2.09	4.20	7,460	1,780	
						2.00	2.03	2.06	4.18	5,800	1,390	
						2.00	2.01	2.05	4.12	6,150	1,490	
						2.00	2.04	2.09	4.26	6,460	1,520	1,470
		Neat.		36.2	44	2.01	2.00	2.09	4.18	6,500	1,560	
						2.01	2.00	2.01	4.02	6,810	1,690	
						2.03	2.00	2.04	4.08	6,880	1,690	
						2.01	2.00	2.07	4.14	7,160	1,730	
						2.01	2.00	2.12	4.24	6,650	1,570	1,650
		Neat.		36.2	93	2.00	2.04	2.06	4.20	5,810	1,380	
						2.00	2.06	2.04	4.20	4,920	1,170	
						2.01	2.03	1.99	4.04	4,200	1,040	
						2.00	2.03	2.01	4.08	6,150	1,510	
						1.98	2.06	2.04	4.20	4,530	1,080	1,240
		Neat.		36.2	97	2.04	2.04	2.00	4.08	5,890	1,440	
						2.01	2.12	2.01	4.26	6,100	1,430	
						2.02	2.08	2.01	4.18	5,880	1,410	
						1.99	2.10	2.00	4.20	5,700	1,360	
						2.00	2.06	2.04	4.20	5,810	1,380	1,400
		Neat.		36.2	104	2.06	2.02	2.02	4.08	6,800	1,670	
						1.98	2.06	2.04	4.20	5,820	1,390	
						2.04	2.04	2.02	4.12	6,300	1,530	
						1.98	2.04	2.03	4.14	5,300	1,280	
						2.02	2.10	1.98	4.16	6,420	1,540	1,480

same age in the air at 70° F. are not here shown to be conspicuousl unlike, notwithstanding the different durations of the preceding intervals of exposure in the freezer at zero temperature.

Diagrams follow showing the curves of strength for each of the three groups, which set in air at 0°, 39°, and 70° F., respectivel. There are also diagrams which show the strength acquired by specimens which set various intervals at zero and at 39° F., after they we removed from the cold storage warehouse and set additional interv at 70° F. temperature.

CEMENTS WHICH SET IN AIR AT DIFFERENT TEMPERATURES.

MEAN RESULTS WITH 2-INCH CUBES.

[Where figures are given in two columns showing the time of setting the cement was first exp the lower temperature, then to the higher, the indicated intervals prior to testing.]

Brand.	Class.	Composition.			Time of setting in air at temperature of—						Compressive strength per square inch.
		Cement.	Sand.	Water.	0° F.		39° F.		70° F.		
				Per ct.	*Mos.*	*Days.*	*Mos.*	*Days.*	*Mos.*	*Days.*	*Pounds.*
Star	Portland	Neat.		23.4		31				1	1,3[illegible]
				23.4		31				7	2,3[illegible]
				23.4		31				30	3,460
				23.4	3					1	1,72[illegible]
				23.4	3					7	2,690
				23.4	3					14	3,300
				23.4	3					30	3,[illegible]
	Portland	Neat.		25.7				29			2,980
				25.7				29		7	3,550
				25.7				29		30	4,200
				25.7			3				3,[illegible]
				25.7			3			7	4,090
				25.7			3			14	4,280
	Portland	Neat.		23.4						29	4,350
				23.4						32	4,570
				23.4						36	4,400
				23.4						38	4,820
				23.4					2		4,840
				23.4					2		4,850
				23.4					3	14	4,410
				24.6					4		4,100
	Portland	1	1	36.1		5				1	287
				36.1		5				7	846
				36.1		14				1	321
				36.1		14				7	1,000
				36.1		21				1	337
				36.1		21				7	1,010
				36.1		31				1	383
				36.1		31				7	981
				36.1		31				30	1,400
				36.1	2					1	416
				36.1	2					7	981
				36.1	2					14	1,250
				36.1	3					1	497
				36.1	3					7	1,010
				36.1	3					14	1,310
	Portland	1	1	32.0				15			1,710
				32.0				15		7	2,710
				32.0				31			1,960
				32.0				31		7	2,720
				32.0				31		21	3,050
				32.0			2				2,460
				32.0			2			7	3,270
				32.0			2			14	3,220
	Portland	1	1	32.0						15	1,970
				32.0						22	2,290
				32.0						31	2,330
				32.0						38	2,520
				32.0					2		2,490

MEAN RESULTS WITH 2-INCH CUBES—Continued.

Brand.	Class.	Composition.			Time of setting in air at temperature of—						Compressive strength per square inch.
		Cement.	Sand.	Water.	0° F.		39° F.		70° F.		
				Per ct.	*Mos.*	*Days.*	*Mos.*	*Days.*	*Mos.*	*Days.*	*Pounds.*
Storm King	Portland	Neat.		24.4		30				1	749
				24.4		30				7	1,310
				24.4		30				31	1,680
				24.4	3					1	703
				24.4	3					7	1,290
				24.4	3					14	1,530
	Portland	Neat.		25.0				32			1,600
				25.0				32		7	1,800
				25.0				32		30	2,590
				25.0			3				2,300
				25.0			3			7	2,530
				25.0			3			30	2,700
	Portland	Neat.		25.0						32	2,520
				25.0						39	2,560
				25.0					2		2,510
				25.0					3		2,430
				25.0					3	7	2,470
				25.0					4		2,380
Alsen	Portland	Neat.		28.2		30				1	986
				28.2		30				7	2,440
				28.2		30				14	2,590
				28.2	3					1	1,210
				28.2	3					7	2,350
				28.2	3					29	2,520
	Portland	Neat.		28.2				21			4,910
				28.2				31			5,250
				28.2				31		7	5,970
				28.2				31		31	6,430
				28.2			3				5,870
				28.2			3			8	6,670
				28.2			3			30	6,400
	Portland	Neat.		28.2						14	3,780
				28.2						21	3,930
				28.2						31	3,900
				28.2						38	3,450
				28.2					2		3,430
				28.2					3		4,040
				28.2					3	9	3,160
				28.2					4		3,510
Josson	Portland	Neat.		27.3		7				1	315
				27.3		7				7	1,470
				27.3		7				14	1,470
				27.3		14				1	231
				27.3		14				7	1,230
				27.3		14				14	1,360
				27.3		21				1	185
				27.3		21				7	1,240
				27.3		21				14	1,490
				27.3		29				1	347
				27.3		29				7	1,430
				27.3		29				14	1,610
				27.3	3					1	624
				27.3	3					7	1,520
				27.3	3					15	1,730
	Portland	Neat.		26.0				28			4,000
				26.0			1				4,010
				26.0			1			7	5,000
				26.0			1			13	5,460
				26.0			1	13			4,380
				26.0			3				4,980
				26.0			3			8	4,970
				26.0			3			14	5,420
	Portland	Neat.		26.0						14	3,330
				26.0						21	3,610
				26.0						28	3,970
				26.0					1		3,730
				26.0					1	5	3,240

MEAN RESULTS WITH 2-INCH CUBES—Continued.

Brand.	Class.	Composition.			Time of setting in air at temperature of—						Compressive strength per square inch.
		Cement.	Sand.	Water.	0° F.		39° F.		70° F.		
				Per ct.	*Mos.*	*Days.*	*Mos.*	*Days.*	*Mos.*	*Days.*	*Pounds.*
Josson	Portland	Neat.		26.0					1	7	3,370
				26.0					1	13	3,350
				26.0					3		3,110
Steel	Slag	Neat.		36.2		7				1	89
				36.2		7				7	369
				36.2		7				14	539
				36.2		14				1	68
				36.2		14				7	387
				36.2		14				14	531
				36.2		21				1	52
				36.2		21				7	412
				36.2		21				14	520
				36.2		33				1	229
				36.2		33				7	735
				36.2		33				14	823
				36.2	3					1	237
				36.2	3					7	558
				36.2	3					15	648
	Slag	Neat.		34.4				15			926
				34.4				15		7	1,480
				34.4				15		14	1,460
				34.4				21			1,110
				34.4				21		7	1,490
				34.4				21		14	1,490
				34.4				32			1,320
				34.4				32		7	1,450
				34.4				32		14	1,550
	Slag	Neat.		34.4						15	1,160
				34.4						21	1,240
				34.4						28	1,310
				34.4						32	1,200
				34.4					1	5	1,250
				34.4					1	9	1,220
				34.4					1	16	1,410
Austin	Natural	Neat.		36.7		30				1	238
				36.7		30				7	448
				36.7		30				14	467
				36.7	3					1	241
				36.7	3					7	340
				36.7	3					14	482
	Natural	Neat.		37.1				30			806
				37.1				30		7	1,020
				37.1				30		14	1,350
				37.1			3				1,030
				37.1			3			7	1,360
				37.1			3			15	1,480
	Natural	Neat.		37.1						30	724
				37.1						37	730
				37.1					1	14	752
				37.1					3		661
				37.1					3	8	639
				37.1					3	15	580
Bonneville improved.	Natural	Neat.		38.4		32				1	411
				38.4		32				7	903
				38.4		32				14	1,010
				38.4	2					1	446
				38.4	2					7	842
				38.4	2					14	1,050
				38.4	3					1	478
				38.4	3					7	810
				38.4	3					14	1,020
	Natural	Neat.		35.9				30			1,200
				35.9				30		7	1,640
				35.9				30		14	1,860
				35.9			2				1,430
				35.9			2			7	1,860
				35.9			2			14	1,970
				35.9			3			2	1,250

MEAN RESULTS WITH 2-INCH CUBES—Continued.

Brand.	Class.	Composition.			Time of setting in air at temperature of—						Compressive strength per square inch.
		Cement.	Sand.	Water.	0° F.		39° F.		70° F.		
				Per ct.	Mos.	Days.	Mos.	Days.	Mos.	Days.	Pounds.
Bonneville improved.	Natural...	Neat.		35.9			3			7	1,880
				35.9			3			13	2,060
	Natural...	Neat.		35.9						15	800
				35.9						30	1,140
				35.9					1	7	1,250
				35.9					1	14	1,200
				35.9					2		1,190
				35.9					2	7	986
				35.9					2	14	1,070
				35.9					3		1,720
Hoffman	Natural...	Neat.		35.7		6				1	169
				35.7		6				7	354
				35.7		6				14	540
				35.7		15				1	182
				35.7		15				7	460
				35.7		15				14	527
				35.7		20				1	168
				35.7		20				7	431
				35.7		20				14	624
				35.7		28				1	206
				35.7		28				7	406
				35.7		28				14	561
				35.7	3					1	276
				35.7	3					7	457
				35.7	3					14	579
	Natural...	Neat.		35.5				8			522
				35.5				8		7	842
				35.5				8		14	1,130
				35.5				14			649
				35.5				14		7	901
				35.5				23			549
				35.5				23		7	1,110
				35.5				28			744
				35.5				28		7	1,120
				36.2				31			952
				36.2				31		7	1,040
				36.2				31		30	1,170
				36.2			3				1,310
				36.2			3			7	1,230
				36.2			3			14	1,470
	Natural...	Neat.		35.5						8	628
				35.5						15	808
				35.5						23	980
				35.5						30	1,140
				35.5						35	1,170
				35.5					3		1,070
				35.5					3	7	1,270
				35.5					3	15	1,090
Norton	Natural...	Neat.		38.0		30				1	341
				38.0		30				7	659
				38.0		30				30	850
				38.0	3					1	347
				38.0	3					7	558
				38.0	3					14	832
	Natural...	Neat.		38.2				30			656
				38.2				30		7	747
				38.2				30		30	1,190
				38.2			3				1,100
				38.2			3			7	1,190
				38.2			3			14	1,440
	Natural...	Neat.		37.9						14	744
				37.9						23	908
				37.9						37	1,040
				37.9					2		1,030
				37.9					3		1,090
				37.9					3	7	924
				37.9					4		950

MEAN RESULTS WITH 2-INCH CUBES—Continued.

Brand.	Class.	Composition.			Time of setting in air at temperature of—						Compressive strength per square inch.
		Cement.	Sand.	Water.	0° F.		39° F.		70° F.		
				Per ct.	*Mos.*	*Days.*	*Mos.*	*Days.*	*Mos.*	*Days.*	*Pounds.*
Obelisk......	Natural...	Neat.	....	38.6	.....	32	.....	......	.....	1	225
	....	....	....	38.6	.....	32	.....	......	.....	7	562
	....	....	....	38.6	.....	32	.....	......	.....	14	609
	....	....	....	38.6	3	......	.....	......	.....	1	274
	....	....	....	38.6	3	......	.....	......	.....	7	516
	....	....	....	38.6	3	......	.....	......	.....	14	674
	Natural...	Neat.	....	36.2	.....	......	.....	30	.....	......	1,11
	....	....	....	36.2	.....	......	.....	30	.....	7	1,60
	....	....	....	36.2	.....	......	.....	30	.....	14	1,81
	....	....	....	36.2	.....	......	3	......	.....	2	1,70
	....	....	....	36.2	.....	......	3	......	.....	6	1,98
	....	....	....	36.2	.....	......	3	......	.....	13	2,15
	Natural...	Neat.	....	36.2	.....	......	.....	......	.....	30	1,50
	....	....	....	36.2	.....	......	.....	......	1	7	1,47
	....	....	....	36.2	.....	......	.....	......	1	14	1,65
	....	....	....	36.2	.....	......	.....	......	3	3	1,24
	....	....	....	36.2	.....	......	.....	......	3	7	1,40
	....	....	....	36.2	.....	......	.....	......	3	14	1,48

RÉSUMÉ OF RESULTS ON SPECIMENS 1 MONTH OLD.

[Specimens exposed to 0° F. temperature while setting, followed by one day in air at 70° F. be testing.]

Brand.	Compressive strength per square inch, specimens set in air at temperatures of—		
	0° F.	39° F.	70° F.
	Pounds.	*Pounds.*	*Pound*
Star	1,350	2,980	4,35
Star, 1:1 mortar	383	1,960	2,35
Storm King	749	1,600	2,52
Alsen	986	5,250	3,90
Josson	347	4,000	3,97
Steel	229	1,320	1,20
Austin	238	806	72
Bonneville Improved	411	1,200	1,14
Hoffman	206	744	1,14
Norton	341	656	a 1,00
Obelisk	225	1,110	1,5
Means	497	1,966	2,16

a Approximate.

RÉSUMÉ OF RESULTS ON SPECIMENS 3 MONTHS OLD.

[Specimens exposed to 0° F. temperature while setting, followed by one day in air at 70° F. before testing.]

Brand.	Compressive strength per square inch, specimens set in air at temperatures of—		
	0° F.	39° F.	70° F.
	Pounds.	*Pounds.*	*Pounds.*
Star	1,720	3,350	[a]4,400
Storm King	703	2,300	2,430
Alsen	1,210	5,870	4,040
Josson	624	4,980	3,110
Austin	241	1,030	661
Bonneville Improved	478	1,250	1,720
Hoffman	276	1,310	1,070
Norton	347	1,100	1,090
Obelisk	274	1,700	1,240
Means	653	2,543	2,196

[a] Approximate.

RÉSUMÉ OF RESULTS ON SPECIMENS 1 MONTH AND 3 MONTHS OLD.

[Specimens set one day in air at 70° F. before testing.]

Brand.	Compressive strength per square inch, specimens set in air at temperature of 0° F.	
	1 month.	3 months.
	Pounds.	*Pounds.*
Star	1,350	1,720
Star, 1 : 1 mortar	383	497
Storm King	749	703
Alsen	986	1,210
Josson	347	624
Steel	229	237
Austin	238	241
Bonneville Improved	411	478
Hoffman	206	276
Norton	341	347
Obelisk	225	274
Means	497	601

RÉSUMÉ OF RESULTS ON SPECIMENS 1 MONTH AND 3 MONTHS OLD.

Brand.	Compressive strength per square inch, specimens set in air at temperature of 39° F.—	
	1 month.	3 months.
	Pounds.	*Pounds.*
Star	2,980	3,350
Storm King	1,600	2,300
Alsen	5,250	5,870
Josson	4,010	4,380
Austin	806	1,030
Bonneville Improved	1,200	1,250
Hoffman	952	1,310
Norton	656	1,100
Obelisk	1,110	1,700
Means	2,063	2,477

RÉSUMÉ OF RESULTS ON SPECIMENS 1 MONTH AND 3 MONTHS OLD.

Brand.	Compressive strength per square inch, specimens set in air at temperature of 70° F.—	
	1 month.	3 months.
	Pounds.	*Pounds.*
Star	4,350	*a* 4,400
Storm King	2,520	2,430
Alsen	3,900	4,040
Josson	3,970	3,110
Austin	724	661
Bonneville Improved	1,140	1,720
Hoffman	1,140	1,070
Norton	*a* 1,000	1,090
Obelisk	1,560	1,240
Means	2,256	2,085

a Approximate.

RÉSUMÉ OF RESULTS ON SPECIMENS SET IN AIR AT 0° F. 1 MONTH, AND IN ADDITION 1 DAY AND 7 DAYS, RESPECTIVELY, AT 70° F.

Brand.	Compressive strength per square inch, specimens set in air at 0° F. 1 month, and in air at 70° F.—	
	1 day.	7 days.
	Pounds.	*Pounds.*
Star	1,350	2,340
Star, 1:1 mortar	383	981
Storm King	749	1,310
Alsen	986	2,440
Josson	347	1,430
Steel	229	735
Austin	238	448
Bonneville Improved	411	903
Hoffman	206	406
Norton	341	659
Obelisk	225	562
Means	497	1,110

RÉSUMÉ OF RESULTS ON SPECIMENS SET IN AIR AT 0° F. 3 MONTHS, AND IN ADDITION 1 DAY AND 7 DAYS, RESPECTIVELY, AT 70° F.

Brand.	Compressive strength per square inch, specimens set in air at 0° F. 3 months, and in air at 70° F.—	
	1 day.	7 days.
	Pounds.	*Pounds.*
Star	1,720	2,690
Star, 1:1 mortar	497	1,010
Storm King	703	1,290
Alsen	1,210	2,350
Josson	624	1,520
Steel	237	558
Austin	241	340
Bonneville Improved	478	810
Hoffman	276	457
Norton	347	558
Obelisk	274	516
Means	600	1,100

COMPARISON OF RESULTS ON SPECIMENS WHICH SET IN AIR AT BOTH 0° F. AND AT 70° F. WITH THOSE WHICH SET IN AIR AT 70° F. ONLY.

Brand.	Compressive strength per square inch.	
	Intervals at 0° and 70° F.	Interval at 70° F.
	Pounds.	*Pounds.*
	3 mos. + 30 days.	30 days.
Star	3,620	4,570
Alsen	2,520	3,900
	1 mo. + 30 days.	30 days.
Star	3,460	4,570
Star, 1:1 mortar	1,400	1,960
Storm King	1,680	2,520
	3 mos. + 14 days.	14 days.
Star, 1:1 mortar	1,310	1,970
Alsen	[a]2,450	3,780
Josson	1,730	3,330
Steel	618	1,160
Bonneville Improved	1,020	800
Hoffman	579	808
Norton	832	744
Means	1,771	2,509

[a] Approximate.

COMPARISON OF RESULTS ON SPECIMENS WHICH SET IN AIR AT BOTH 39° AND 70° F WITH THOSE WHICH SET IN AIR AT 70° F. ONLY, EXHIBITING THOSE OF THE SERIES WHICH SET THE LONGEST INTERVALS OF TIME AT THE TWO TEMPERATURES MENTIONED.

Brand.	Compressive strength per square inch.	
	Intervals at 39° and 70° F.	Interval at 70° F.
	Pounds.	*Pounds.*
Star	3 mos. + 14 days. 4,280	3 mos., 14 days. 4,410
Storm King	3 mos. + 1 mo. 2,700	4 mos. 2,380
Alsen	3 mos. + 1 mo. 6,400	4 mos. 3,510
Josson	3 mos. + 8 days. 4,970	3 mos. 3,110
Austin	3 mos. + 15 days. 1,480	3 mos., 15 days. 580
Bonneville Improved	2 mos. + 14 days. 1,970	2 mos., 14 days. 1,070
Bonneville Improved	3 mos. + 13 days. 2,960	3 mos. 1,720
Hoffman	3 mos. + 14 days. 1,470	3 mos., 15 days. 1,090
Norton	3 mos. + 7 days. 1,190	3 mos., 7 days. 924
Norton	3 mos. + 14 days. 1,440	4 mos. 950
Obelisk	3 mos. + 13 days. 2,150	3 mos., 14 days. 1,480
Means	2,737	1,929

RESULTS ARRANGED TO SHOW THE GAIN IN STRENGTH OF SPECIMENS WHICH SET IN AIR DIFFERENT INTERVALS OF TIME AT 0° F., FOLLOWED BY INTERVALS AT 70° F.

Brand.	Time of setting in air at—				Compressive strength per square inch.	Gain per square inch.
	0° F.		70° F.			
	Months.	*Days.*	*Months.*	*Days.*	*Pounds.*	*Pounds.*
Star		31		1	1,350	990
		31		7	2,340	
	3			1	1,720	970
	3			7	2,690	
Star, 1:1 mortar		5		1	287	559
		5		7	846	
		14		1	321	679
		14		7	1,000	
		21		1	337	673
		21		7	1,010	
		31		1	383	598
		31		7	981	
	2			1	416	565
	2			7	981	
	3			1	497	513
	3			7	1,010	
Storm King		30		1	749	561
		30		7	1,310	
	3			1	703	587
	3			7	1,290	
Alsen		30		1	986	1,454
		30		7	2,440	
	3			1	1,210	1,140
	3			7	2,350	
Josson		7		1	315	1,155
		7		7	1,470	
		14		1	231	999
		14		7	1,230	
		21		1	185	1,055
		21		7	1,240	
		29		1	347	1,083
		29		7	1,430	
	3			1	624	896
	3			7	1,520	
Austin		30		1	238	210
		30		7	448	
	3			1	241	99
	3			7	340	
Bonneville Improved		32		1	411	492
		32		7	903	
	2			1	446	396
	2			7	842	
	3			1	478	332
	3			7	810	
Hoffman		6		1	169	185
		6		7	354	
		15		1	182	278
		15		7	460	
		20		1	168	263
		20		7	431	

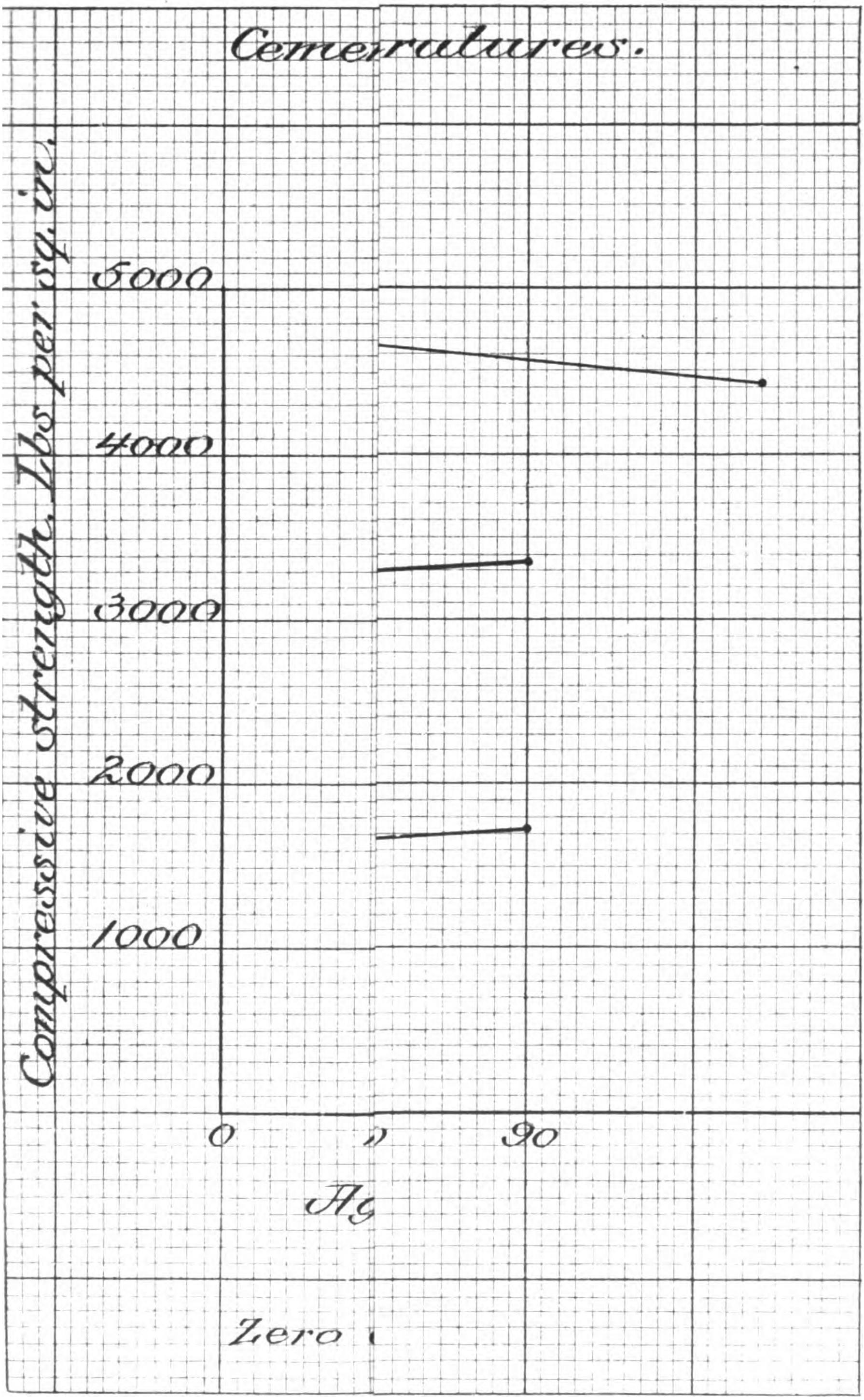
RESULTS ARRANGED TO SHOW THE GAIN IN STRENGTH OF SPECIMENS WHICH SET IN AIR DIFFERENT INTERVALS OF TIME AT 70° F.—Continued.

Brand.	Time of setting in air.		Compressive strength per square inch.	Gain per square inch.
	Months.	*Days.*	*Pounds.*	*Pounds.*
Josson	1	0	3,730	−360
	1	7	3,370	
Austin	....	30	724	6
	....	37	730	
	3	0	661	− 22
	3	8	639	
Bonneville Improved	1	0	1,140	90
	1	7	1,250	
	2	0	1,190	−204
	2	7	986	
Hoffman	....	8	628	180
	....	15	808	
	....	23	980	160
	....	30	1,140	
	3	0	1,070	200
	3	7	1,270	
Norton	3	0	1,090	−166
	3	7	924	
Obelisk	1	0	1,560	− 90
	1	7	1,470	
	3	3	1,240	160
	3	7	1,400	

RÉSUMÉ OF RESULTS, SHOWING THE COMPARATIVE GAIN IN STRENGTH OVER CORRESPONDING INTERVALS OF TIME OF SPECIMENS WHICH SET IN AIR AT DIFFERENT TEMPERATURES.

Brand.	Gain in comprehensive strength per square inch after 6 days or 7 days in air at 70° F., succeeding—		
	1 mo. at 0° + 1 day at 70° F.	1 mo. at 39° F.	1 mo. at 70° F.
	Pounds.	*Pounds.*	*Pounds.*
Star	990	570	220
Star, 1:1 mortar	598	760	− 10
Storm King	561	200	40
Alsen	1,451	720	−450
Josson	1,083	990	−360
Austin	210	214	6
Bonneville Improved	192	440	90
Hoffman	250	376	....
Norton	318	91	....
Obelisk	337	490	− 90
	3 mos. at 0° + 1 day at 70° F.	3 mos. at 39° F.	3 mos. at 70° F.
Star	970	740	....
Alsen	1,140	800	*a* −880
Josson	896	330	....
Austin	99	330	*b* − 22
Bonneville Improved	332	*c* 630	....
Hoffman	181	− 80	200
Obelisk	242	*d* 280	*d* 160

a 9-day interval. *b* 8-day interval. *c* 5-day interval. *d* 4-day interval.



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RESULTS ARRANGED TO SHOW THE GAIN IN STRENGTH OF SPECIMENS WHICH SET AIR DIFFERENT INTERVALS OF TIME AT 70° F.—Continued.

Brand.	Time of setting in air.		Compressive strength per square inch.	Gain per square inch.
	Months.	*Days.*	*Pounds.*	*Pounds*
Josson	1	0	3,730	−36
	1	7	3,370	
Austin		30	724	6
		37	730	
	3	0	661	−2
	3	8	639	
Bonneville Improved	1	0	1,140	9
	1	7	1,250	
	2	0	1,190	−204
	2	7	986	
Hoffman		8	628	18
		15	808	
		23	980	16
		30	1,140	
	3	0	1,070	20
	3	7	1,270	
Norton	3	0	1,090	−16
	3	7	924	
Obelisk	1	0	1,560	−9
	1	7	1,470	
	3	3	1,240	16
	3	7	1,400	

RÉSUMÉ OF RESULTS, SHOWING THE COMPARATIVE GAIN IN STRENGTH OVER COR SPONDING INTERVALS OF TIME OF SPECIMENS WHICH SET IN AIR AT DIFFER TEMPERATURES.

Brand.	Gain in comprehensive strength per square inch after 6 days or 7 days in air at 70° F., succeeding—		
	1 mo. at 0 +1 day at 70° F.	1 mo. at 39° F.	1 mo. at 70° F.
	Pounds.	*Pounds.*	*Pounds.*
Star	990	570	220
Star, 1:1 mortar	598	760	−10
Storm King	561	200	40
Alsen	1,454	720	−450
Josson	1,083	990	−360
Austin	210	214	6
Bonneville Improved	492	440	90
Hoffman	250	376	....
Norton	318	91	....
Obelisk	587	490	90
	3 mos. at 0 + 1 day at 70° F.	3 mos. at 39° F.	3 mos. at 70° F.
Star	970	740	....
Alsen	1,140	800	[a]880
Josson	896	330	....
Austin	90	330	[b]22
Bonneville Improved	232	[c]630	....
Hoffman	182	80	200
Obelisk	242	[d]280	[d]160

[a] 2-day interval. [b] 8-day interval. [c] 5-day interval. [d] 4-day interval.

RESULTS ARRANGED TO SHOW THE GAIN IN STRENGTH OF SPECIMENS WHICH SET AIR DIFFERENT INTERVALS OF TIME AT 70° F.—Continued.

Brand.	Time of setting in air.		Compressive strength per square inch.	Gain per square inch
	Months.	*Days.*	*Pounds.*	*Pounds.*
Josson	1	0	3,730	−36
	1	7	3,370	
Austin		30	724	6
		37	730	
	3	0	661	−2
	3	8	639	
Bonneville Improved	1	0	1,140	9
	1	7	1,250	
	2	0	1,190	−20
	2	7	986	
Hoffman		8	628	18
		15	808	
		23	980	16
		30	1,140	
	3	0	1,070	20
	3	7	1,270	
Norton	3	0	1,090	−16
	3	7	924	
Obelisk	1	0	1,560	−9
	1	7	1,470	
	3	3	1,240	16
	3	7	1,400	

RÉSUMÉ OF RESULTS, SHOWING THE COMPARATIVE GAIN IN STRENGTH OVER COR SPONDING INTERVALS OF TIME OF SPECIMENS WHICH SET IN AIR AT DIFFERE TEMPERATURES.

Brand.	Gain in comprehensive strength per square inch after 6 days or 7 days in air at 70° F., succeeding—		
	1 mo. at 0° + 1 day at 70° F.	1 mo. at 39° F.	1 mo. at 70° F.
	Pounds.	*Pounds.*	*Pounds.*
Star	990	570	220
Star, 1:1 mortar	598	760	− 10
Storm King	561	200	40
Alsen	1,451	720	−450
Josson	1,083	990	−360
Austin	210	214	6
Bonneville Improved	492	440	90
Hoffman	230	376	....
Norton	318	91	....
Obelisk	337	490	− 90
	3 mos. at 0° + 1 day at 70° F.	3 mos. at 39° F.	3 mos. at 70° F.
Star	970	740	....
Alsen	1,149	800	[a] −880
Josson	896	330	....
Austin	93	330	[b] − 22
Bonneville Improved	332	[c] 630	....
Hoffman	181	80	200
Obelisk	242	[d] 280	[d] 160

[a] 9-day interval. [b] 8-day interval. [c] 5-day interval. [d] 4-day interval.

RESULTS ARRANGED TO SHOW THE STRENGTH OF SPECIMENS AFTER THE LAPSE OF GIVEN INTERVALS OF TIME AT 70° F. IN ADDITION TO DIFFERENT INTERVALS AT 0° F.

Brand.	Interval at 0° F.		Subsequent interval at 70° F.	Compressive strength per square inch.
	Months.	*Days.*	*Days.*	*Pounds.*
Star		31	7	2,340
	3	0	7	2,690
Star, 1:1 mortar		5	7	846
		14	7	1,000
		21	7	1,010
		31	7	981
	2	0	7	981
	3	0	7	1,010
Storm King		30	7	1,310
	3	0	7	1,290
Alsen		30	7	2,440
	3	0	7	2,350
Josson		7	7	1,470
		14	7	1,230
		21	7	1,240
		29	7	1,430
	3	0	7	1,520
Austin		30	7	448
	3	0	7	340
Bonneville Improved		32	7	903
	2	0	7	842
	3	0	7	810
Hoffman		6	7	354
		15	7	460
		20	7	431
		28	7	406
	3	0	7	457
Norton		30	7	659
	3	0	7	558
Obelisk		32	7	569
	3	0	7	516
Star, 1:1 mortar	2	0	14	1,250
	3	0	14	1,310
Josson		7	14	1,470
		14	14	1,360
		21	14	1,490
		29	14	1,610
	3	0	15	1,730
Austin		30	14	467
	3	0	14	482
Bonneville Improved		32	14	1,010
	2	0	14	1,050
	3	0	14	1,020
Hoffman		6	14	540
		15	14	527
		20	14	624
		28	14	561
	3	0	14	579
Obelisk		32	14	609
	3	0	14	671

COMPRESSION TESTS OF CEMENTS.

Specimens set in air at ordinary temperatures. Amount of water used in mixing stated in per cent of the amount of cement by weight.

Marks.	Brand of cement.	Composition.			Time of setting in—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	Air.	Water.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	Days.	Days.	Inches.	Inches.	Inches.	Sq. inches.	Pounds.	Pounds.	Pounds.	
Atl. F. 27	Atlas	Neat.		35.1	30	0	2.03	2.00	2.08	4.16	13,500	3,250		Sifted material. Grains finer than ″.0027 diameter.
							2.00	2.02	2.09	4.22	13,090	3,100		
							2.01	2.10	2.00	4.20	11,400	2,710		
							1.99	2.00	2.04	4.08	9,700	2,380		
							2.05	2.06	2.00	4.12	10,900	2,650		
							2.00	2.08	2.06	4.28	12,400	2,900		
							2.00	2.08	2.00	4.16	11,900	2,860		
							2.02	2.00	2.14	4.28	11,280	2,640		
							2.01	2.06	2.01	4.14	12,900	3,120		
							2.02	2.08	2.00	4.16	11,310	2,720		
							2.00	2.10	2.00	4.20	8,600	2,050		
							2.02	2.10	2.01	4.22	11,980	2,840	2,770	
Atl. 1 + 1 F. 27.	Atlas	1	1	39.7	31	0	2.04	2.02	2.07	4.18	9,800	2,340		Sifted material. Grains of cement finer than ″.0027 diameter.
							2.00	2.02	2.04	4.12	9,550	2,320		
							1.99	2.07	2.04	4.22	14,600	3,460		
							2.02	2.10	2.00	4.20	15,500	3,690		
							2.01	2.09	2.01	4.20	12,810	3,050		
							2.01	2.00	2.07	4.14	13,850	3,350		
							2.00	1.98	2.10	4.16	11,150	2,680		
							1.98	2.10	2.00	4.20	12,800	3,050		
							2.00	2.01	2.10	4.22	9,70C	2,300		
							2.00	2.04	2.03	4.14	13,050	3,150		
							1.98	2.04	2.06	4.20	12,800	8,050		
							2.00	2.00	2.06	4.12	11,020	2,670		
							2.05	2.00	2.08	4.16	8,980	2,160		
							2.00	2.10	2.04	4.28	11,010	2,570		
							2.02	2.00	2.09	4.18	9,300	2,220		
							1.99	2.02	2.01	4.06	12,800	3,150		
							2.00	2.01	2.07	4.22	14,600	3,460		
							2.00	2.12	2.01	4.20	10,000	2,490	2,800	

☆Feb. 27	Star	Neat.		35.2	30	0	2.00	2.07	1.97	4.08	15,150	3,710		Sifted material. Grains finer than ".0027 diameter.
							2.00	1.98	2.08	4.12	14,120	3,430		
							1.95	2.08	1.97	4.10	14,810	3,610		
							1.99	1.97	2.05	4.04	14,010	3,470		
							1.99	1.97	2.10	4.14	13,360	3,230		
							1.99	1.97	2.08	4.10	14,330	3,500		
							1.99	1.97	2.08	4.10	14,300	3,490		
							1.96	1.96	2.08	4.08	14,400	3,530		
							1.98	2.09	2.00	4.18	12,300	2,940		
							1.96	1.97	2.10	4.14	11,100	2,680	3,360	
☆Mar. 2	Star	Neat.		20.0	31	0	2.01	2.06	1.75	3.61	1,590	440	440	Sifted material. Grains coarser than ".0058 diameter.
☆F. 27	Star	1	1	43.9	30	0	1.98	1.97	2.07	4.08	11,580	2,840		Sifted material. Grains of cement finer than ".0027 diameter.
							1.98	2.00	2.03	4.06	11,970	2,950		
							1.97	2.09	2.02	4.22	12,920	3,060		
							1.99	2.00	2.07	4.14	11,300	2,730		
							2.02	2.04	1.97	4.02	12,570	3,130		
							2.02	1.98	2.03	4.02	12,080	3,000		
							1.98	1.98	2.09	4.14	9,220	2,230		
							2.01	1.98	2.02	4.00	12,290	3,070		
							1.98	1.97	2.12	4.18	8,600	2,060		
							1.99	2.05	2.00	4.10	10,690	2,610	2,770	
S. K. M. 28	Storm King	Neat.		29.4	1	0	1.98	2.04	1.96	4.00	2,280	570		
							2.00	2.00	2.10	4.20	2,700	643		
							2.00	2.06	1.97	4.06	2,350	579		
							1.98	2.04	2.02	4.12	2,200	534		
							2.00	2.02	1.99	4.02	2,250	560	577	
		Neat.		29.4	7	0	2.01	2.03	2.05	4.16	5,350	1,290		
							2.00	2.02	2.05	4.14	5,910	1,430		
							2.00	2.00	2.05	4.10	5,710	1,390		
							1.98	1.99	2.08	4.14	5,700	1,380		
							2.00	2.01	2.03	4.08	6,210	1,520	1,400	
		Neat.		29.4	14	0	2.00	2.00	2.02	4.04	7,620	1,890		
							2.00	1.99	2.02	4.02	7,700	1,920		
							2.00	2.00	2.02	4.04	6,900	1,710		
							2.00	1.99	2.03	4.04	6,800	1,680		
							1.98	2.09	1.96	4.10	7,800	1,900	1,820	
		Neat.		29.4	30	0	2.02	2.00	2.01	4.08	8,450	2,070		
							1.99	1.98	2.04	4.04	8,210	2,030		
							1.99	2.00	2.02	4.04	8,480	2,100		
							1.99	1.99	2.07	4.12	9,400	2,280		
							1.99	1.98	2.02	4.00	9,280	2,320	2,160	

Compression tests of cements—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	Air.	Water.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
Aln. M. 25	Alsen	Neat.		29.2	1	0	2.02	2.02	2.04	4.12	6,080	1,480		
							2.02	2.02	2.05	4.14	4,100	990		
							2.03	2.02	2.04	4.12	4,750	1,150		
							2.04	2.04	2.00	4.08	4,310	1,060		
							2.00	2.04	2.03	4.14	4,200	1,010	1,140	
		Neat.		29.2	7	0	2.02	2.08	2.00	4.16	15,000	3,610		
							2.06	2.02	2.04	4.12	15,400	3,740		
							2.02	2.02	2.00	4.04	17,380	4,300		
							2.05	2.09	2.01	4.20	15,330	3,650		
							2.04	2.00	2.01	4.02	18,500	4,600	3,980	
		Neat.		29.2	14	0	1.99	2.00	2.06	4.12	16,900	4,100		
							2.06	2.00	2.07	4.14	15,650	3,780		
							2.04	2.00	2.05	4.14	15,460	3,730		
							2.06	2.02	2.05	4.14	16,400	3,960		
							2.05	2.00	2.08	4.16	14,900	3,580	3,830	
		Neat.		29.2	30	0	2.02	2.06	2.04	4.20	17,400	4,140		
							2.04	2.04	1.99	4.06	15,600	3,840		
							2.00	2.06	2.03	4.18	18,700	4,470		
							2.02	2.00	2.08	4.16	18,720	4,500		
							2.00	2.03	2.08	4.22	16,410	3,890	4,170	
Stl. M. 28	Steel	Neat.		34.9	1	0	1.99	2.04	2.02	4.12	650	158		
							2.03	2.00	2.04	4.08	600	147		
							1.98	2.02	2.04	4.12	630	153		
							1.98	2.02	2.02	4.08	640	157		
							2.04	2.02	1.97	3.98	590	148	153	
		Neat.		34.9	7	0	1.99	1.99	2.01	4.00	3,890	975		
							1.98	2.04	1.96	4.00	3,820	955		
							1.99	2.00	2.00	4.00	4,270	1,070		
							1.98	2.00	2.00	4.00	4,080	1,020		
							1.98	2.00	1.99	3.98	4,100	1,030	1,010	
		Neat.		34.9	14	0	1.97	2.00	2.02	4.04	4,610	1,140		
							1.99	2.04	1.99	4.06	4,500	1,110		
							1.98	2.01	2.01	4.04	4,650	1,150		
							1.99	2.01	2.02	4.06	4,610	1,140		
							1.99	2.01	2.03	4.08	4,710	1,160	1,140	

		Neat.		34.9	30	0	1.98	2.00	1.98	3.96	4,540	1,150		
							1.99	1.96	1.97	3.86	5,220	1,350		
							1.99	1.99	1.98	3.94	5,100	1,290		
							2.01	1.98	1.99	3.94	5,350	1,360		
							1.97	1.99	2.01	4.00	5,470	1,370	1,300	
Stl. Apr. 3	Steel	Neat.		40.4	30	0	1.98	1.99	1.98	3.94	4,810	1,220		Sifted material. Grains finer than ".0027 diameter.
							2.00	1.98	1.94	3.84	4,300	1,120		
							1.99	1.97	1.97	3.88	4,100	1,060		
							2.00	1.98	1.96	3.98	4,530	1,170		
							2.00	1.97	1.99	3.92	4,610	1,180		
							1.98	1.94	1.99	3.86	4,340	1,120		
							1.99	1.96	1.98	3.88	4,480	1,150		
							1.98	1.99	1.99	3.96	4,500	1,140		
							1.97	1.96	1.99	3.90	4,250	1,090		
							1.99	1.98	1.99	3.94	4,210	1,070		
							1.99	1.97	1.98	3.90	4,680	1,200		
							1.99	1.94	1.98	3.84	4,560	1,190	1,140	
		1	1	50.9	30	0	1.96	2.04	2.03	4.14	3,190	771		Sifted material. Grains of cement finer than ".0027 diameter.
							1.96	2.03	2.08	4.22	3,150	747		
							1.95	2.01	2.04	4.10	2,940	722		
							2.01	2.06	1.98	4.08	3,680	902		
							1.97	1.99	2.02	4.02	3,410	848		
							2.03	1.99	2.06	4.10	3,650	890		
							2.03	1.98	2.06	4.08	3,400	833		
							1.97	2.05	1.98	4.06	3,290	810		
							1.97	2.02	2.07	4.18	2,870	687		
							1.98	2.00	2.04	4.08	3,580	877		
							1.98	1.98	2.04	4.04	3,470	859	813	
S. 2	Cathedral	Neat.			1	0	2.00	2.01	1.99	4.00	3,450	863		
							2.02	2.00	2.00	4.00	3,500	875		
							1.99	2.03	2.03	4.12	3,510	852		
							2.06	2.01	2.00	4.02	3,570	888		
							2.04	2.04	2.01	4.10	3,550	866	867	
		Neat.			7	0	1.98	1.99	1.96	3.90	8,990	2,310		
							2.00	2.08	1.99	4.14	9,060	2,190		
							1.99	2.03	1.99	4.04	9,450	2,340		
							1.99	2.05	1.98	4.06	9,200	2,270		
							1.98	2.01	1.97	4.02	8,950	2,230	2,270	
		Neat.			1	6	1.98	2.05	2.01	4.12	9,300	2,260		
							1.98	2.02	1.99	4.02	9,660	2,400		
							1.97	2.05	1.98	4.06	9,400	2,320		
							1.98	2.02	1.97	3.98	8,300	2,090		
							1.97	2.02	1.97	3.98	8,800	2,210	2,260	

Compression tests of cements—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	Air.	Water.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
L. 3, May 17	Lehigh	Neat.			7	0	1.98	2.02	1.99	4.02	16,410	4,080		
							1.98	2.00	2.01	4.02	21,910	5,450		
							2.00	2.02	1.96	3.96	17,500	4,420		
							1.99	2.02	1.96	3.96	19,540	4,940		
							2.02	2.00	1.98	3.96	17,320	4,380		
							2.01	2.01	2.00	4.02	16,880	4,200		
							2.02	2.02	2.00	4.04	17,940	4,440		
							2.02	2.03	1.96	3.98	18,910	4,750		
							1.96	2.04	2.00	4.08	18,750	4,600		
							2.04	2.03	2.00	4.06	16,600	4,090	4,540	
		Neat.			14	0	1.95	2.03	1.98	4.02	17,800	4,430		
							1.98	2.03	1.95	3.96	17,200	4,340		
							1.97	2.02	1.96	3.96	18,950	4,790		
							2.00	2.04	1.98	4.04	18,270	4,520		
							2.04	2.03	2.02	4.10	24,100	5,880		
							2.03	2.03	1.99	4.04	23,210	5,740		
							1.99	2.00	1.96	3.92	19,600	5,000		
							1.96	2.02	2.01	4.06	27,700	6,820		
							1.99	2.07	1.99	4.12	21,600	5,240		
							1.98	2.03	2.00	4.06	21,650	5,340	5,210	
		Neat.			21	0	2.05	2.01	2.00	4.02	19,900	4,950		
							1.99	2.04	2.01	4.10	24,500	5,980		
							2.00	2.03	2.00	4.06	23,100	5,690		
							1.97	2.04	1.96	4.00	18,800	4,700		
							1.98	2.00	1.97	3.94	22,200	5,640		
							1.98	2.01	2.02	4.06	22,750	5,600		
							1.97	2.01	1.97	3.96	22,600	5,710		
							2.00	1.97	1.98	3.90	23,700	6,080		
							2.00	2.02	2.05	4.14	23,100	5,580		
							1.99	2.05	1.97	4.04	22,670	5,610	5,550	
		Neat.			30	0	2.00	2.00	2.00	4.00	24,900	6,230		
							2.03	1.99	2.03	4.04	20,100	4,980		
							2.02	2.00	2.03	4.06	20,900	5,150		
							2.00	2.03	2.01	4.08	27,400	6,720		
							2.00	2.03	2.01	4.08	25,000	6,130		
							2.03	1.96	2.00	3.92	24,900	6,350		
							1.99	2.02	2.03	4.10	25,050	6,110		

		......	......	......	......	......	2.00	1.96	2.01	3.94	21,600	5,480	....
		......	......	......	......	......	1.97	1.97	2.02	3.98	20,100	5,050	....
		......	......	......	......	......	1.98	1.97	2.03	4.00	21,700	5,430	5,760
Aus., Apr. 2....	Austin..........	Neat.		34.9	1	0	2.02	1.98	2.10	4.16	1,500	361	....
		......	......	......	......	......	2.01	2.00	2.10	4.20	1,490	355	....
		......	......	......	......	......	1.95	2.07	2.01	4.16	1,540	370	....
		......	......	......	......	......	2.02	2.10	2.01	4.22	1,460	346	....
		......	......	......	......	......	2.02	2.00	2.09	4.18	1,580	378	362
		Neat.		34.9	7	0	2.01	2.00	2.04	4.08	2,100	515	....
		......	......	......	......	......	2.02	2.05	1.98	4.06	1,910	470	....
		......	......	......	......	......	2.02	2.02	2.09	4.22	2,190	519	....
		......	......	......	......	......	2.00	2.02	2.07	4.22	2,250	533	....
		......	......	......	......	......	2.02	2.01	2.08	4.18	2,560	612	530
		Neat.		34.9	30	0	2.04	2.10	1.99	4.18	3,510	840	....
		......	......	......	......	......	2.00	2.08	2.00	4.16	3,900	938	....
		......	......	......	......	......	1.99	2.08	2.02	4.20	4,240	1,010	....
		......	......	......	......	......	2.01	1.98	2.08	4.12	4,170	1,010	....
		......	......	......	......	......	2.01	2.08	2.00	4.16	3,300	793	918
		Neat.		34.9	1	13	2.02	2.02	2.08	4.20	2,680	638	....
		......	......	......	......	......	2.00	1.96	2.08	4.08	2,640	647	....
		......	......	......	......	......	2.00	2.07	2.02	4.18	2,700	646	....
		......	......	......	......	......	2.00	2.02	2.08	4.20	2,500	595	....
		......	......	......	......	......	2.02	2.01	2.06	4.14	2,700	652	636
H. Mar 25.....	Hoffman	Neat.	....	33.3	1	0	2.02	2.02	2.07	4.18	1,120	268	....
		......	......	......	......	......	2.04	2.09	2.06	4.30	1,020	237	....
		......	......	......	......	......	2.02	2.04	2.03	4.14	1,160	280	....
		......	......	......	......	......	2.06	2.02	2.09	4.22	1,110	263	....
		......	......	......	......	......	2.02	2.04	2.10	4.28	1,090	255	261
		Neat.	....	33.3	7	0	2.10	2.03	2.06	4.18	2,250	538	....
		......	......	......	......	......	2.04	2.10	2.03	4.26	2,330	547	....
		......	......	......	......	......	2.02	2.07	2.10	4.35	2,310	531	....
		......	......	......	......	......	2.03	2.04	2.10	4.28	2,460	575	....
		......	......	......	......	......	2.05	2.09	2.02	4.22	2,220	526	543
		Neat.	....	33.3	14	0	2.02	2.07	2.01	4.16	2,750	661	....
		......	......	......	......	......	2.05	2.09	2.01	4.20	2,900	690	....
		......	......	......	......	......	2.08	2.03	2.08	4.22	2,880	682	....
		......	......	......	......	......	2.02	2.04	2.08	4.24	2,700	637	....
		......	......	......	......	......	2.03	2.03	2.08	4.22	2,990	709	676
		Neat	....	33.3	30	0	2.10	2.09	2.02	4.22	4,570	1,080	....
		......	......	......	......	......	2.03	2.02	2.08	4.20	4,100	976	....
		......	......	......	......	......	2.04	2.03	2.06	4.18	4,200	1,000	....
		......	......	......	......	......	2.01	2.08	2.03	4.22	4,210	998	1,010

Compression tests of cements—Continued.

arks.	Brand of cement.	Composition.			Time of setting in—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	Air.	Water.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
27	Hoffman	Neat.		45.0	31	0	1.95	2.01	1.98	3.98	810	204		Sifted material. Grains finer than ″.0027 diameter.
							2.00	2.01	1.96	3.94	720	183		
							1.97	2.00	1.99	3.98	690	173		
							2.00	2.02	1.97	3.98	610	153		
							1.96	2.04	1.97	4.02	680	169		
							1.96	2.02	1.96	3.96	620	157		
							1.99	1.96	2.00	3.92	1,200	306		
							1.96	1.97	2.03	4.00	1,050	263		
							1.94	2.03	2.02	4.10	1,100	268		
							1.96	1.93	2.03	3.92	1,010	258		
							1.94	2.02	1.98	4.00	1,100	275		
							1.94	2.02	1.98	4.00	810	203	218	
H. Mar. 2	Hoffman	Neat.		39.2	31	0	2.03	2.08	2.00	4.20	200	48		Sifted material. Grains coarser than ″.0058 diameter.
							2.01	2.05	2.06	4.22	210	50		
							2.00	2.05	2.03	4.16	370	89	62	
H. 1 - 1 Mar. 5	Hoffman	1	1	47.9	30	0	1.99	2.03	2.00	4.06	820	202		Sifted material. Grains of cement finer than ″.0027 diameter. Corners gone in this group of specimens.
							2.02	2.03	1.98	4.02	990	246		
							1.99	2.02	2.02	4.08	890	218		
							1.98	2.01	2.03	4.08	900	221		
							1.98	2.01	2.02	4.06	810	200	217	
H. 1×1 Mar. 1	Hoffman	1	1	64.6	31	0	1.99	2.03	1.97	4.00	590	143		Sifted material. Grains of cement finer than ″.0027 diameter.
							2.00	2.01	2.04	4.10	480	117		
							2.00	2.02	2.00	4.04	580	144		
							1.98	2.02	1.99	4.02	470	117		
							2.00	2.02	1.96	3.96	480	121		
							2.00	1.98	2.00	3.96	500	126		
							2.02	2.05	2.00	4.10	520	127		
							2.01	1.98	2.04	4.04	710	176		
							1.97	2.03	1.97	4.00	450	113		
							2.00	2.03	1.98	4.02	460	114		
							2.00	2.03	2.02	4.10	640	156		
							1.98	2.03	2.01	4.08	470	115	131	
M., Apr. 2	Mankato	Neat.		49.1	1	0	2.02	2.00	2.05	4.10	950	232		
							2.00	2.04	2.00	4.08	900	221		
							2.00	2.02	2.04	4.12	890	216		
							2.01	2.03	2.06	4.18	920	220		
							2.04	2.00	2.07	4.14	910	220	222	

		Neat.		49.1	7	0	2.04	2.01	2.04	4.10	1,900	463	
							2.02	2.02	2.09	4.22	1,990	472	
							2.04	2.02	2.04	4.12	1,950	473	
							2.01	2.03	2.05	4.16	1,900	457	
							2.02	2.01	2.04	4.10	1,850	451	463
		Neat.		49.1	30	0	2.02	2.04	2.00	4.08	3,290	806	
							2.00	2.03	2.04	4.14	2,770	669	
							2.02	2.00	2.06	4.12	3,270	794	
							1.99	2.07	2.00	4.14	3,310	800	
							2.00	2.02	2.03	4.10	3,320	810	776
M., Mar. 1	Mankato	Neat.		46.1	30	0	1.98	2.05	2.03	4.16	2,480	596		Sifted material. Grains coarser than ".0058 diameter.
							1.98	2.01	2.08	4.18	2,210	529		
							1.96	1.98	2.08	4.12	1,990	483		
							1.97	2.05	2.00	4.10	1,970	480		
							1.98	2.02	2.08	4.20	2,240	533		
							2.01	1.98	2.10	4.16	2,580	620	540	
		Neat.		44.8	30	0	2.02	1.98	2.08	4.12	3,230	784		
							1.99	1.96	2.09	4.10	3,610	880		
							1.99	1.98	2.06	4.08	3,210	787		
							2.02	1.98	2.08	4.12	3,570	867		
							1.99	1.95	2.10	4.10	3,010	734		
							2.00	2.01	1.99	4.06	2,800	690	790	
M., Mar. 1	Mankato	Neat.		49.4	31	0	1.98	2.00	2.00	4.00	2,240	560		Corner gone. Sifted material. Grains finer than ".0027 diameter.
							1.98	1.98	1.97	3.90	3,010	772		
							1.96	2.00	2.00	4.00	2,990	748		
							1.98	2.04	2.02	4.12	3,050	740		
							2.00	2.00	2.00	4.00	3,300	825		
							2.03	2.01	1.98	3.98	3,190	802	740	
M., Apr. 2	Mankato	Neat.		49.1	1	13	2.02	2.02	2.08	4.20	2,400	571		
							2.02	2.00	2.04	4.08	2,380	583		
							2.01	2.04	2.02	4.12	2,650	643		
							2.01	2.05	2.02	4.14	2,770	669		
							2.03	2.02	2.01	4.06	2,390	589	611	
N., Mar. 25	Norton	Neat.		37.5	1	0	2.00	2.03	2.08	4.22	1,000	237		
							1.98	2.02	2.13	4.30	910	212		
							2.03	1.99	2.10	4.18	920	220		
							2.02	2.10	2.00	4.20	920	219		
							2.00	2.10	2.01	4.22	990	235	225	
		Neat.		37.5	7	0	2.00	2.00	2.10	4.20	2,100	500		
							2.02	2.09	2.00	4.18	1,990	476		
							2.00	2.02	2.05	4.14	2,120	512		
							2.00	2.08	2.00	4.16	1,650	397		
							2.00	1.99	2.07	4.12	2,040	495	476	

Compression tests of cements—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	Air.	Water.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
N., Mar. 25	Norton	Neat.	....	37.5	14	0	2.02	1.98	2.10	4.16	2,550	613	....	
		....	....	....	....	....	2.01	2.00	2.06	4.12	2,600	631	....	
		....	....	....	....	....	2.01	2.01	2.08	4.18	2,400	574	....	
		....	....	....	....	....	1.99	2.04	2.01	4.10	2,480	605	....	
		....	....	....	....	....	2.00	2.02	2.05	4.14	2,570	621	609	
		Neat.	....	37.5	30	0	2.00	1.99	2.07	4.12	3,940	956	....	
		....	....	....	....	....	2.00	2.00	2.08	4.16	3,790	911	....	
		....	....	....	....	....	2.00	2.04	2.05	4.18	3,200	766	878	
N., F. 27	Norton	Neat.	....	42.8	31	0	2.02	2.00	2.06	4.12	1,360	330	....	Sifted material. Grains finer than ″.0027 diameter.
		....	....	....	....	....	2.02	2.04	2.00	4.08	1,980	485	....	
		....	....	....	....	....	2.00	2.05	2.02	4.14	1,460	353	....	
		....	....	....	....	....	2.00	2.04	2.00	4.08	1,600	392	....	
		....	....	....	....	....	2.00	2.10	2.03	4.26	1,710	401	....	
		....	....	....	....	....	2.00	2.06	2.00	4.12	1,680	408	....	
		....	....	....	....	....	2.06	1.98	2.07	4.10	1,590	388	....	
		....	....	....	....	....	2.04	2.06	2.03	4.18	2,170	519	410	
N., Mar. 2	Norton	Neat.	....	46.1	31	0	2.02	2.02	2.04	4.12	1,150	279	....	Sifted material. Grains coarser than ″.0058 diameter.
		....	....	....	....	....	2.00	2.08	2.09	4.35	1,100	253	....	
		....	....	....	....	....	2.02	2.07	2.07	4.28	1,540	360	297	
N., 1×1, Mar. 3.	Norton	1	1	43.7	30	0	1.98	2.12	1.96	4.16	1,600	385	....	Corner gone.
		....	....	....	....	....	1.96	1.99	2.10	4.22	1,250	296	....	Sifted material. Grains of cement finer than ″.0027 diameter.
		....	....	....	....	....	2.00	2.10	2.01	4.22	1,500	355	....	
		....	....	....	....	....	2.00	2.10	1.97	4.14	1,270	307	336	
N., 1×1, F. 27	Norton	1	1	45.6	31	0	1.96	2.05	2.01	4.12	1,400	340	....	
		....	....	....	....	....	1.96	2.04	1.99	4.06	1,500	369	....	Sifted material. Grains of cement finer than ″.0027 diameter.
		....	....	....	....	....	1.96	1.98	2.03	4.02	1,390	346	....	
		....	....	....	....	....	1.97	2.03	2.00	4.06	1,550	382	....	
		....	....	....	....	....	1.96	2.02	1.98	4.00	1,390	348	....	
		....	....	....	....	....	1.96	2.03	1.98	4.02	1,380	343	....	
		....	....	....	....	....	1.96	2.02	1.98	4.00	1,450	362	....	
		....	....	....	....	....	2.00	2.04	2.08	4.24	1,100	259	....	
		....	....	....	....	....	2.00	2.04	2.04	4.16	1,100	267	....	
		....	....	....	....	....	1.98	2.05	1.95	4.00	1,350	338	335	

O.. Mar. 25	Obelisk	Neat.		39.3	1	0	2.03	2.03	2.00	4.06	1,300	320	
							2.03	2.00	2.01	4.08	1,320	324	
							2.03	2.04	1.99	4.06	1,210	298	
							2.02	2.04	2.01	4.10	1,330	324	
							2.00	2.03	2.01	4.08	1,390	311	321
		Neat.		39.3	7	0	1.98	1.98	2.03	4.02	2,580	642	
							2.03	2.02	2.00	4.04	2,940	728	
							2.00	1.98	2.02	4.00	2,890	723	
							1.99	2.02	2.01	4.12	3,180	772	
							2.02	2.00	2.04	4.08	2,580	632	699
		Neat.		39.4	14	0	2.00	2.01	2.02	4.06	3,700	911	
							2.01	2.02	2.00	4.04	3,790	938	
							2.02	2.00	2.00	4.00	3,980	995	
							2.01	2.01	2.02	4.06	3,710	914	
							2.01	2.02	2.00	4.04	4,140	1,020	956
		Neat.		39.3	30	0	1.99	2.00	2.04	4.08	5,300	1,300	
							1.99	2.01	2.02	4.12	5,790	1,410	
							2.01	2.00	2.05	4.10	5,810	1,420	
							2.01	2.01	1.99	4.06	5,650	1,390	
							2.00	2.04	1.99	4.06	5,250	1,290	1,360
P. H. C.. Apr. 4	Potomac	Neat.		38.2	1	0	2.00	2.09	2.02	4.22	600	142	
							2.00	2.16	1.98	4.28	630	147	
							2.00	2.10	1.99	4.18	570	132	
							1.98	2.01	2.00	4.02	600	149	
							2.00	2.00	2.12	4.24	650	153	145
		Neat.		38.2	7	0	2.00	1.99	2.12	4.22	1,750	415	
							2.00	2.01	2.13	4.24	1,600	377	
							2.01	1.99	2.12	4.22	1,670	396	
							2.02	2.00	2.09	4.18	1,740	416	
							2.00	2.00	2.10	4.20	1,730	412	403
		Neat.		38.2	14	0	1.97	2.00	2.13	4.26	2,500	587	
							2.02	1.99	2.12	4.22	2,560	607	
							2.00	2.10	2.00	4.20	2,410	574	
							1.98	1.99	2.08	4.11	2,450	592	590
		Neat.		38.2	30	0	2.02	1.98	2.12	4.20	4,100	976	
							2.00	1.99	2.07	4.12	4,530	1,100	
							2.00	2.06	2.00	4.12	4,270	1,040	
							2.01	2.11	1.98	4.18	3,990	955	
							2.02	1.98	2.12	4.20	4,200	1,000	1,010
		Neat.		38.0	1	6	1.98	2.07	2.01	4.16	1,250	296	
							1.99	2.00	2.08	4.16	1,340	322	
							1.97	2.02	2.08	4.20	1,190	283	
							2.00	2.01	2.09	4.20	1,280	305	
							2.03	1.98	2.10	4.16	1,400	337	309

Compression tests of cements—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	Air.	Water.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
P. H. C., Apr. 4	Potomac	Neat.		38.0	1	13	2.02	2.06	2.01	4.14	1,870	452		
							2.01	2.00	2.07	4.14	1,800	435		
							2.01	2.00	2.06	4.12	1,950	473		
							2.01	2.01	2.08	4.18	1,780	426		
							1.98	2.00	2.06	4.12	1,830	444	446	
		Neat.		38.0	1	30	1.99	2.08	2.02	4.20	3,310	788		
							2.00	2.07	2.01	4.16	3,720	894		
							2.02	2.02	2.08	4.20	3,210	764		
							2.01	2.06	2.02	4.16	3,200	769		
							2.02	2.02	2.07	4.18	3,410	816	806	
Ak	Akron Star	Neat.		35.2	7	0	2.00	2.02	2.01	4.06	4,460	1,100		
							1.99	2.00	2.02	4.04	3,810	943		
							2.00	2.02	2.02	4.08	4,150	1,020		
							2.00	2.04	2.00	4.08	3,700	907		
							2.00	2.00	2.02	4.04	3,300	817	957	
		Neat.		35.2	30	0	1.98	2.00	2.00	4.00	6,500	1,630		
							1.98	1.99	2.01	4.00	6,670	1,670		
							1.98	1.98	1.98	3.92	7,850	2,000		
							1.98	2.00	2.00	4.00	7,180	1,800		
							1.99	1.96	1.99	3.90	7,000	1,800	1,780	
Ak. 1:1	Akron Star	1	1	40.6	7	0	2.00	2.01	2.01	4.04	3,740	926		
							2.00	2.04	2.01	4.10	3,090	754		
							2.00	1.99	2.05	4.08	3,810	934		
							2.01	1.99	2.05	4.08	3,490	855		
							2.00	2.04	2.01	4.10	3,400	829	860	
		1	1	40.6	30	0	2.01	2.02	2.00	4.04	5,650	1,400		
							2.01	2.08	1.99	4.14	5,110	1,230		
							2.02	2.00	2.00	4.00	4,600	1,150		
							2.00	1.98	2.04	4.04	5,200	1,290		
							2.00	1.98	2.04	4.04	5,210	1,290	1,272	
Ak 1:2	Akron Star	1	2	52.5	7	0	2.03	2.04	2.05	4.18	2,130	510		
							2.06	2.02	2.03	4.10	1,820	444		
							2.02	2.04	2.04	4.16	2,010	483		
							2.02	2.02	2.12	4.28	1,430	334		
							2.03	2.03	2.02	4.10	1,790	437	442	

Ak. 1×2	**Akron Star**	1	2	52.5	30	0	2.03	2.08	2.00	4.16	2,610	627		
							2.05	2.06	2.04	4.20	3,700	881		
							2.02	2.02	2.05	4.14	3,000	725		
							2.04	2.04	2.04	4.16	1,990	478		
							2.04	2.02	2.03	4.10	2,810	685	679	
Ak. 1×3	Akron Star	1	3	75.0	7	0	2.00	2.02	2.03	4.10	810	198		
							2.00	2.02	2.03	4.10	970	237		
							2.00	2.02	2.05	4.14	980	237		
							1.99	2.01	2.04	4.10	790	193		Corners gone.
							1.99	2.00	2.02	4.01	760	188	211	
		1	3	75.0	30	0	2.00	2.01	2.04	4.10	1,200	293		
							1.99	2.02	2.04	4.12	1,220	296		
							2.00	2.04	2.00	4.08	1,150	282		
							1.98	2.05	2.02	4.14	1,100	266		
							2.00	2.03	2.00	4.06	1,080	266	281	
Ak. 1×4	Akron Star	1	4	89.6	7	0	2.03	1.99	2.08	4.14	458	111		
							1.98	2.02	2.06	4.16	513	123		
							2.00	2.07	2.02	4.18	393	94		
							1.98	2.05	2.03	4.16	543	131		
							2.02	2.06	2.00	4.12	348	84	109	
		1	4		7	0	2.00	1.82	1.99	3.62	450	124		
							1.99	1.90	2.00	3.80	400	105		
							1.99	1.94	2.01	3.90	440	113		
							2.00	2.03	2.08	4.22	410	97	110	
		1	4	89.6	30	0	1.99	2.03	2.02	4.10	650	159		
							2.02	2.06	1.99	4.10	590	144		
							2.03	2.09	2.00	4.18	510	122		
							2.00	2.06	2.04	4.20	490	117		
							2.03	2.01	2.10	4.22	480	114	131	Corner gone.
		1	4		60	0	2.01	1.99	1.86	3.70	520	141		
							2.00	2.01	2.10	4.22	530	126		
							2.03	2.00	2.12	4.21	410	97		
							2.01	2.01	2.11	4.24	420	99	116	
Ak	Akron Star	Neat.		35.2	1	6	2.00	1.98	2.01	3.98	3,010	756		
							2.00	1.98	2.02	4.00	2,750	688		
							2.00	1.98	2.02	4.00	2,880	720		
							2.00	1.96	2.02	3.96	2,810	710		
							1.99	1.99	2.01	4.00	2,690	673	709	
		Neat.		35.2	1	29	1.99	2.01	2.02	4.06	4,280	1,050		
							1.98	2.00	2.00	4.00	5,200	1,300		
							2.00	2.00	2.01	4.02	4,400	1,090		
							1.99	2.00	2.02	4.04	4,910	1,220		
							2.00	2.01	2.00	4.02	4,600	1,140	1.160	

Compression tests of cements—Continued.

Marks.	Brand of cement.	Composition.			Time of setting in—		Dimensions.			Sectional area.	Ultimate strength.			Remarks.
		Cement.	Sand.	Water.	Air.	Water.	Height.	Compressed surface.			Total.	Per square inch.	Mean.	
				Per cent.	*Days.*	*Days.*	*Inches.*	*Inches.*	*Inches.*	*Sq. Inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
Ak. 1-1	Akron Star	1	1	40.6	1	6	1.99	2.09	2.02	4.22	2,750	652	....	
		....	....	....	....	....	2.00	2.06	2.01	4.14	2,640	638	....	
		....	....	....	....	....	1.99	2.00	2.03	4.06	2,600	640	....	
		....	....	....	....	....	2.00	2.00	2.05	4.10	2,590	632	....	
		....	....	....	....	....	1.99	2.00	2.05	4.10	2,500	610	634	
		1	1	40.6	1	29	1.99	2.08	2.00	4.16	3,450	829	....	
		....	....	....	....	....	2.00	2.05	2.00	4.14	3,800	918	....	
		....	....	....	....	....	1.98	2.01	2.03	4.08	3,650	895	....	
		....	....	....	....	....	2.00	2.03	2.01	4.08	3,480	853	....	
		....	....	....	....	....	1.99	2.08	2.00	4.16	3,400	817	862	
Ak. 1-2	Akron Star	1	2	52.5	1	6	2.02	2.05	2.11	4.33	1,350	312	....	
		....	....	....	....	....	2.04	2.03	2.07	4.20	1,300	310	....	
		....	....	....	....	....	2.03	2.04	2.03	4.14	1,200	290	....	
		....	....	....	....	....	2.02	2.04	2.06	4.20	1,170	279	....	
		....	....	....	....	....	2.00	2.00	2.08	4.16	1,250	300	298	
		1	2	52.5	1	29	2.06	2.04	2.02	4.12	1,610	391	....	
		....	....	....	....	....	2.08	2.02	2.04	4.12	2,050	497	....	
		....	....	....	....	....	2.02	2.05	2.06	4.22	1,810	429	....	
		....	....	....	....	....	2.03	2.03	2.05	4.16	1,970	474	....	
		....	....	....	....	....	2.03	2.04	2.05	4.18	1,950	467	452	
Ak. 1-3	Akron Star	1	3	75.0	1	6	2.02	2.00	2.03	4.06	460	113	....	
		....	....	....	....	....	1.98	2.04	2.05	4.18	470	112	....	
		....	....	....	....	....	1.99	2.04	2.03	4.14	410	99	....	
		....	....	....	....	....	2.00	2.03	2.04	4.14	450	109	108	
		1	3	75.0	1	29	2.00	2.05	2.04	4.18	990	237	....	
		....	....	....	....	....	2.00	2.06	2.05	4.22	1,080	256	....	
		....	....	....	....	....	1.99	2.03	2.07	4.20	910	217	....	
		....	....	....	....	....	2.00	2.07	2.05	4.24	970	229	....	
		....	....	....	....	....	2.00	2.04	2.01	4.10	880	215	231	
Ak. 1-4	Akron Star	1	4	89.6	1	6	2.03	2.00	2.09	4.18	183	44	....	
		....	....	....	....	....	2.01	2.00	2.07	4.14	243	59	....	
		....	....	....	....	....	2.00	2.04	2.08	4.24	203	48	....	
		....	....	....	....	....	2.02	2.09	1.97	4.12	238	58	52	

Ak. 1 × 4.......	Akron..........	1	4	....	1	6	1.92	2.02	2.03	4.10	170	41	....
		....	....	....	....	....	2.01	2.02	2.13	4.30	210	49	....
		....	....	....	....	....	2.03	2.00	2.12	4.24	260	61	....
		....	....	....	....	....	2.01	2.00	2.14	4.28	250	58	52
		1	4	89.6	1	29	1.99	2.07	2.02	4.18	350	84	....
		....	....	....	....	....	2.03	2.05	1.99	4.08	570	140	....
		....	....	....	....	....	1.99	1.99	2.15	4.28	310	72	....
		....	....	....	....	....	2.02	2.09	1.99	4.16	400	96	....
		....	....	....	....	....	2.00	2.09	2.00	4.18	270	65	91
		1	4	....	1	59	2.03	2.01	2.11	4.24	1,090	257	....
		....	....	....	....	....	2.00	2.02	1.88	3.80	1,110	292	....
		....	....	....	....	....	2.04	2.00	2.06	4.12	1,340	325	....
		....	....	....	....	....	2.01	2.01	2.18	4.38	1,240	283	289

COMPRESSION TESTS OF CEMENTS AND MORTARS AFTER HAVING BEEN HEATED TO DIFFERENT TEMPERATURES.

The specimens were at atmospheric temperatures at the time of testing.

Marks.	Brand of cement.	Composition.		Age.		Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Cement.	Sand.			Height.	Compressed surface.				Total.	Per square inch.	
				Years.	Months.	Inches.	Inches.	Inches.	Sq. inches.	Pounds.	Pounds.	Pounds.	
7	Alpha	1	2	1	2	4.08	4.07	4.04	16.44	34,100	34,100	2,074	Not heated.
8	....	....	....	1	2	4.06	4.04	4.10	16.56	35,800	35,800	2,162	
9	....	....	....	1	2	4.10	4.04	4.07	16.44	31,400	31,400	1,910	
12	....	....	....	1	2	4.04	4.02	4.08	16.40	17,500	26,700	1,628	
13	....	....	....	1	2	3.92	4.03	4.09	16.48	44,600	47,900	2,907	Heated to 405° F.
14	....	....	....	1	2	4.00	4.03	4.13	16.64	35,500	36,500	2,194	
15	....	....	....	1	2	4.03	4.02	4.07	16.36	48,900	48,900	2,989	
20	....	....	....	1	2	4.12	4.03	4.10	16.52	50,700	50,700	3,069	Heated to 312° F.
21	....	....	....	1	2	4.13	4.07	4.07	16.56	33,400	38,000	2,295	
22	....	....	....	1	2	4.05	4.02	4.07	16.36	41,700	47,400	2,897	
23	....	....	....	1	2	4.12	4.02	4.09	16.44	46,800	49,000	2,981	
28	....	Neat.	....	1	2	3.90	4.05	4.10	16.60	134,600	134,600	8,109	Not heated.
30	....	....	....	1	2	3.91	4.02	4.08	16.40	113,200	113,200	6,902	Heated to 302° F.
31	....	....	....	1	2	3.90	4.06	4.00	16.24	98,000	109,200	6,724	Heated to 535° F.
16	Alpha	1	2	1	3	4.13	4.07	4.04	16.44	41,200	41,200	2,506	Heated to 750° F.
17	....	....	....	1	3	4.09	4.09	4.05	16.56	....	25,100	1,516	Heated to 1,060° F.; cracked during heating.
24	Alpha	1	2	1	3	4.11	4.02	4.05	16.28	54,300	54,300	3,335	Heated to 267° F.
25	....	....	....	1	3	4.06	4.07	4.03	16.40	54,800	54,800	3,341	Heated to 508° F.
26	....	....	....	1	3	4.13	4.14	4.02	16.64	53,700	53,700	3,227	Heated to 302° F.
27	....	....	....	1	3	4.05	4.01	4.06	16.28	52,100	52,100	3,200	Heated to 271° F.
18	Alpha	1	2	1	4	4.06	4.02	4.10	16.48	37,000	39,020	2,368	Heated to 625° F.
19	....	....	....	1	4	4.03	4.03	4.04	16.28	45,100	45,100	2,770	Heated to 500° F.
29	....	Neat.	....	1	3½	3.90	4.04	4.08	16.48	31,000	98,400	5,971	Heated to 600° F.
32	....	....	....	1	3½	3.94	4.06	4.00	16.24	29,000	89,800	5,530	Heated to 800° F.

Compression Tests of Halves of Tensile Briquettes.

In this series, fragments of tensile briquettes were used, in which a wide range in strength had been found. The age of the material at the time of each test is stated in the table:

Tensile briquette No.	Brand.	Tensile test.			Compression test.				
		Age in—		Per square inch.	Sectional area.	Age.		Total.	Per square inch.
		Air.	Water.						
		Days.	*Days.*	*Pounds.*	*Sq. ins.*	*Mos.*	*Days.*	*Pounds.*	*Pounds.*
25	Atlas	1	6	1,066	2.80	1	20	22,050	7,875
30		1	6	1,012	2.83	1	20	33,700	11,908
34		1	6	957	2.89	1	20	33,600	11,626
36		1	6	775	2.78	1	20	31,020	11,158
40		1	6	759	2.35	1	19	28,100	11,957
120		1	6	738	2.90	1	8	25,800	8,896
121		1	6	698	2.82	1	8	25,900	9,184
124		1	6	654	2.46	1	8	19,500	7,927
126		1	6	615	2.92	1	8	26,100	8,938
85	Storm King	1	6	174	2.27	1	15	8,300	3,656
86		1	6	331	2.56	1	15	10,620	4,148
87		1	6	354	2.37	1	15	8,100	3,418
89		1	6	189	2.24	1	14	8,640	3,857
91		7	......	372	2.53	1	14	7,560	2,988
95		7	......	443	2.16	1	14	7,020	3,250
96		7	......	543	2.26	1	14	7,540	3,336
167	Alsen	1	6	714	2.26	......	24	12,500	5,531
168		1	6	670	2.36	......	24	13,300	5,635
173		1	6	755	2.91	......	23	16,500	5,670
176		7	......	446	2.53	......	23	13,270	5,245
182		7	......	391	2.58	......	21	11,300	4,380
138	Dyckerhoff	7	......	471	2.54	1	8	13,900	5,472
139		7	......	515	2.65	1	8	16,300	6,151
144		7	......	226	2.73	1	7	14,400	5,275
145		7	......	279	2.56	1	7	14,300	5,586
245	Steel	1	6	298	2.22	......	13	3,840	1,730
246		1	6	332	2.67	......	13	5,300	1,985
247		7	......	99	2.37	......	13	4,720	1,991
248		7	......	149	2.48	......	13	4,520	1,822
249		7	......	139	2.20	......	13	4,100	1,864
221	Bonneville Improved	1	6	196	2.39	......	15	4,100	1,715
222		1	6	158	2.10	......	15	3,180	1,514
224		1	6	42	2.22	......	15	3,120	1,405
225		1	6	81	2.22	......	15	3,020	1,360
229		7	......	201	2.14	......	14	2,710	1,266
230		7	......	73	2.24	......	14	2,710	1,209
235		7	......	196	2.11	......	14	2,400	1,137
236		7	......	99	2.03	......	14	2,520	1,241
188	Hoffman	1	6	156	2.48	......	21	5,060	2,040
189		1	6	133	2.41	......	21	4,920	2,041
193		7	......	60	1.94	......	20	3,030	1,562
195		7	......	53	2.22	......	20	3,890	1,752
197		7	......	243	2.56	......	20	4,660	1,820
198		7	......	225	2.35	......	20	4,550	1,936
201		7	......	275	2.28	......	20	4,420	1,939
202	Norton	1	6	141	2.33	......	18	4,180	1,794
203		1	6	173	2.33	......	18	4,700	2,017
213		7	......	145	2.26	......	17	4,060	1,796
214		7	......	111	2.00	......	17	3,020	1,510
216		7	......	307	2.17	......	16	3,760	1,733
219		7	......	339	2.22	......	16	4,090	1,842
146	Obelisk	1	6	177	2.57	......	25	7,400	2,879
148		1	6	204	2.21	......	25	5,860	2,652
156		7	......	419	2.33	......	25	5,900	2,532
163		7	......	351	2.48	......	25	5,750	2,318

CONCRETE AND MORTAR CUBES MADE AT WATERTOWN ARSENAL.

Tests of cubes 1 and 2 years old, continued from Report of 1899, page 783. Cubes set in air in a dry, cool building.

Marks.	Brand of cement.	Composition.			Age.		Weight.			Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Cement.	Sand.	Broken stone.			Total.		Per cubic foot	Height.	Compressed surface.				Total.	Per square inch.	
					Years.	*Mos.*	*Lbs.*	*Ozs.*	*Pounds.*	*Inches*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
78	Alpha Portland	1	2	0	1		131	0	131.3	11.97	12.00	12.00	144.00	695,000	695,000	4,826	
79					1		131	0	132.4	11.87	12.00	12.00	144.00	709,000	709,000	4,924	
80					1		131	0	132.0	11.92	11.98	12.01	143.88	707,500	707,500	4,917	
81					1		131	0	131.4	11.90	12.03	12.03	144.72	695,000	695,000	4,802	
82					1		131	0	132.4	11.86	11.99	12.02	144.12	730,000	730,000	5,065	
154	Alpha Portland	1	2	4—⅜″ trap	1		142	0	142.6	11.92	12.01	12.02	144.36	439,500	439,500	3,044	
155					1		143	8	144.0	11.94	12.01	12.01	144.24	453,100	453,100	3,141	
156					1		143	8	144.1	11.95	12.00	12.00	144.00	516,800	516,800	3,589	
157					1		144	8	145.1	11.90	12.02	12.03	144.60	479,800	479,800	3,318	
158					1		142	12	142.2	11.98	12.02	12.05	144.84	401,000	401,000	2,769	
159					1		144	8	143.8	11.98	12.07	12.01	144.96	474,800	474,800	3,275	
168	Alpha Portland	1	3	6—⅜″ trap	1		136	12	137.2	11.89	12.02	12.05	144.84	238,000	238,000	1,643	
169					1		139	8	138.0	12.08	12.02	12.03	144.60	271,400	271,400	1,877	
170					1		138	0	138.8	11.84	12.05	12.04	145.08	270,500	270,500	1,864	
171					1		138	4	139.6	11.88	12.00	12.00	144.00	314,000	314,000	2,180	
172					1		138	8	138.8	11.98	11.99	12.00	143.88	291,000	291,000	2,022	
173					1		138	0	138.6	11.90	12.02	12.03	144.60	320,500	320,500	2,216	
174					1		137	8	138.7	11.90	12.01	11.99	144.00	332,400	332,400	2,308	
175					1		139	12	139.5	11.96	12.04	12.02	144.72	354,200	354,200	2,447	
181	Alpha Portland	1	4	8—⅜″ trap	1		138	0	138.3	11.94	12.01	12.02	144.36	215,800	215,800	1,495	
182					1		136	0	136.1	11.94	12.04	12.01	144.60	199,900	200,900	1,389	
183					1		136	4	137.4	11.89	12.00	12.01	144.12	224,600	224,600	1,558	
184					1		135	8	135.6	11.92	12.00	12.07	144.84	201,500	201,500	1,391	
185					1		139	8	139.6	11.94	12.02	12.08	144.60	240,300	240,300	1,662	
192	Alpha Portland	1	5	10—⅜″ trap	1		135	4	136.2	11.87	12.04	12.01	144.60	124,000	125,000	864	
193					1		132	4	131.0	12.09	12.01	12.01	144.24	106,600	106,600	739	
194					1		136	0	136.8	11.93	12.01	11.99	144.00	193,500	193,500	1,344	
195					1		137	4	136.7	12.03	12.01	12.01	144.24	162,600	163,200	1,131	
197					1		132	0	131.8	11.93	12.02	12.07	145.08	97,300	97,300	671	

206	Alpha Portland ..	1	6	12—⅜" trap....	1	......				12.06	12.03	12.04	144.84	107,100	107,100	739	Corners gone.	
207					1	......				12.05	12.07	12.01	144.96	96,400	96,400	665	Do.	
208					1	......				11.88	12.02	12.02	144.48	124,300	124,300	860	Do.	
209					1	......				11.90	12.04	12.02	144.72	116,400	119,900	828	Do.	
210					1	......				12.01	12.01	11.97	143.76	117,900	117,900	820	Do.	
212					1	......				11.92	12.01	12.02	144.36	87,200	87,200	604	Do.	
213					1	......				11.92	12.00	12.02	144.24	138,600	146,800	1,018	Do.	
305	Alpha Portland ..	1	2	4—1½" and 2½" trap.	2	......	150	8	151.6	11.87	12.06	11.98	144.48	368,000	448,000	3,101	2 lbs. 0 oz.	Loss in weight during last 20 months.
306					2	......	148	12	149.1	11.96	12.01	12.00	144.12	394,000	426,000	2,956	1 lb. 4 ozs.	
307					2	......	146	4	146.5	11.89	12.05	12.05	145.20	354,000	382,000	2,629	1 lb. 12 ozs.	
308					2	......	154	12	153.3	12.06	12.03	12.02	144.60	303,000	392,900	2,717	1 lb. 4 ozs.	
309					2	......	151	0	151.9	11.90	12.02	12.01	144.36	382,000	412,000	2,854	1 lb. 4 ozs.	
330	Alpha Portland ..	1	2	4—1" and 2½" trap.	2	......	144	12	135.1	11.79	12.05	12.02	144.84	318,000	346,500	2,392	0 lbs. 4 ozs.	Loss in weight during last 21 months.
331					2	......	146	0	147.7	11.77	12.05	12.04	145.08	260,000	329,800	2,273	0 lbs. 8 ozs.	
332					2	......	147	4	146.9	11.94	12.05	12.04	145.08	381,000	383,000	2,640		
333					2	......	147	4	147.6	11.90	12.03	12.04	144.84	359,000	369,500	2,551	0 lbs. 12 ozs.	
334					2	......	148	0	148.9	11.86	12.05	12.02	144.84	347,000	396,200	2,735	0 lbs. 8 ozs.	
345	Alpha Portland ..	1	2	4—2½" trap....	2	......	147	4	147.1	11.95	12.02	12.04	144.72	244,000	264,800	1,830	2 lbs. 0 ozs.	Loss in weight during last 21 months.
346					2	......	145	12	145.4	11.95	12.02	12.06	144.96	248,000	267,500	1,845	2 lbs. 4 ozs.	
347					2	......	148	4	148.9	11.93	12.00	12.02	144.24	329,000	377,200	2,615	1 lb. 12 ozs.	
348					2	......	148	12	149.9	11.85	12.04	12.02	144.72	332,000	391,700	2,707	1 lb. 4 ozs.	
349					2	......	153	8	152.7	11.98	12.04	12.04	144.96	320,000	483,200	3,333	1 lb. 4 ozs.	
385	Alpha Portland ..	1	2	7—2½" trap....	1	2	148	8	....	12.00	12.06	12.04	145.20	282,000	313,500	2,159	Voids in lower half.	
386					1	2	146	0	....	11.89	12.03	12.05	144.96	302,000	335,000	2,311	Do.	
387					1	2	155	0	154.6	11.90	12.08	12.05	145.56	329,000	376,200	2,584		
388					1	2	148	0	....	11.94	12.03	12.01	144.48	251,000	324,100	2,243	Do.	
389					1	2	154	0	152.2	12.06	12.05	12.03	144.96	308,000	373,500	2,577	Do.	
390					1	2	153	8	153.8	11.89	12.00	12.09	145.08	290,000	373,000	2,571	Do.	
391					1	2	152	0	152.5	11.93	12.02	12.01	144.36	306,000	346,200	2,398	Do.	
412	Steel Portland....	1	2	1—2½" trap....	1	2	151	8	152.4	11.91	12.02	12.00	144.24	230,784	297,000	2,059		
413					1	2	149	0	150.6	11.81	12.04	12.02	144.72	272,000	294,000	2,032		
414					1	2	148	0	149.2	11.86	12.01	12.03	144.48	266,000	283,500	1,962		
415					1	2	151	0	150.9	12.00	12.00	12.01	144.12	273,000	281,000	1,950		
416					1	2	147	8	148.6	11.89	12.00	12.02	144.24	251,000	263,000	1,823		
417	Steel Portland ...	1	2	4—2½" trap....	2	......	154	0	153.0[a]	12.00	12.04	12.04	144.96	243,000	299,400	2,065	2 lbs. 0 oz.	Loss in weight during last 20 months.
418					2	......	151	12	151.1	12.02	12.01	12.02	144.36	294,000	328,000	2,272	1 lb. 12 ozs.	
419					2	......	150	0	150.4	11.93	12.02	12.02	144.48	310,000	324,000	2,243	1 lb. 8 ozs.	
420					2	......	150	12	150.9	11.90	12.04	12.05	145.08	298,000	301,000	2,075	2 lbs. 0 oz.	
421					2	......	149	0	148.4	11.99	12.05	12.01	144.72	283,000	297,400	2,055	1 lb. 4 ozs.	

[a] Granite dust.

Concrete and mortar cubes made at Watertown Arsenal—Continued.

Marks.	Brand of cement.	Composition.			Age.		Weight.			Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Cement.	Sand.	Broken stone.			Total.		Per cubic foot.	Height.	Compressed surface.				Total.	Per square inch.	
					Years.	*Mos.*	*Lbs.*	*Ozs.*	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
437	Norton's Rosendale.	1	2	4—2½″ trap....	1	2	148	0	148.5	11.89	12.06	12.01	144.84	99,000	132,400	914	
438	....	......	......	....	1	2	143	0	144.8	11.83	12.02	12.00	144.24	71,000	93,400	648	
439	....	......	......	....	1	2	142	8	142.3	11.95	12.04	12.03	144.84	72,000	84,700	585	
440	....	......	......	....	1	2	147	8	147.6	11.94	12.03	12.02	144.60	86,760	117,700	814	
441	....	......	......	....	1	2	144	0	143.9	11.98	12.01	12.02	144.36	72,400	88,600	614	
447	Alpha Portland ..	1	2	4—1½″ to 3″ pebbles.	1	2	150	0	148.8	12.02	12.04	12.04	144.96	405,888	492,864	3,400	
448	....	......	......	....	1	2	149	8	148.5	12.01	12.03	12.04	144.84	468,000	529,000	3,652	
449	....	......	......	....	1	2	148	0	146.5	12.08	12.01	12.03	144.48	471,000	525,000	3,634	
450	....	......	......	....	1	2	149	0	147.9	12.01	12.03	12.05	144.96	479,000	532,000	3,670	
451	....	......	......	....	1	2	148	8	146.9	12.06	12.05	12.02	144.84	435,000	493,000	3,403	
457	Alpha Portland ..	1	2	4—1½″ to 2½″ broken brick.	1	2	131	0	130.6	11.93	12.02	12.02	144.48	421,000	486,000	3,364	
458	....	......	......	....	1	2	132	0	131.8	11.92	12.07	12.03	145.20	454,000	488,500	3,364	
459	....	......	......	....	1	2	130	8	129.8	11.95	12.07	12.04	145.32	368,000	436,000	3,000	
460	....	......	......	....	1	2	130	8	130.3	11.97	12.03	12.02	144.60	389,000	454,000	3,140	
461	....	......	......	....	1	2	131	0	130.6	11.98	12.04	12.02	144.72	434,160	501,000	3,462	
469	Alpha Portland ..	1	3	6—1½″ to 2½″ broken brick.	1	1	128	8	128.1	12.00	12.03	12.01	144.48	370,000	419,000	2,900	
470	....	......	......	....	1	1	128	8	127.5	12.05	12.04	12.00	144.48	389,000	435,000	3,011	
471	....	......	......	....	1	1	128	8	127.0	12.07	12.04	12.03	144.84	336,000	402,300	2,778	
472	....	......	......	....	1	1	127	0	126.0	11.98	12.08	12.04	145.44	331,000	361,000	2,482	
473	....	......	......	....	1	1	126	0	125.9	11.92	12.03	12.06	145.08	312,000	364,000	2,509	
474	....	......	......	....	1	1	125	0	124.8	12.00	12.00	12.02	144.24	270,000	293,500	2,035	
475	....	......	......	....	1	1	126	8	125.9	12.01	12.02	12.03	144.60	318,120	355,000	2,455	
476	Alpha Portland ..	1	4	0................	1	1	120	0	120.3	11.88	12.03	12.06	145.08	173,000	173,000	1,192	
477	....	......	......	....	1	1	120	0	120.1	11.87	12.04	12.05	145.08	241,000	241,000	1,661	
478	....	......	......	....	1	1	120	0	120.8	11.88	12.03	12.01	144.48	202,500	202,500	1,401	
479	....	......	......	....	1	1	120	8	119.7	11.98	12.04	12.06	145.20	222,000	222,000	1,529	

Marks, 78.
Composition: Alpha Portland cement, 1; granite dust, 2.
Water used in mortar, 40.8 per cent of cement.
Age, 1 year.
Weight per cubic foot, 131.3 pounds.
Sectional area, 144.00 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,400	100	0.	0.	Initial load.
25,800	200	.0001	0.	
57,600	400	.0003	0.	
86,400	600	.0007	0.	E=3,571,000 pounds per square inch.
115,200	800	.0010	0.	
144,000	1,000	.0013	0.	E=3,461,000 pounds per square inch.
172,800	1,200	.0016	0.	
201,600	1,400	.0019	0.	E=3,125,000 pounds per square inch.
230,400	1,600	.0022	0.	
259,200	1,800	.0026	.0001	
288,000	2,000	.0030	.0001	
316,800	2,200	.0034	.0002	
345,600	2,400	.0039	.0003	
374,400	2,600	.0043	.0003	
403,200	2,800	.0047	.0005	
432,000	3,000	.0053	.0007	
460,800	3,200	.0061	.0009	
489,600	3,400	.0067	.0011	
518,400	3,600	.0076	.0013	
547,200	3,800	.0084	.0016	
576,000	4,000	.0098	.0021	
604,800	4,200	.0109	.0024	
633,600	4,400	.0126	.0033	
662,400	4,600	.0146	.0042	
691,200	4,800	.0168	.0054	
695,000	4,826	....	....	First crack and ultimate strength.

Marks, 156.
Composition: Alpha Portland cement, 1; sand, 2; ¾″ trap rock, 4.
Water used in mortar, 54.4 per cent of cement.
Age, 1 year.
Weight per cubic foot, 144.1 pounds.
Sectional area, 144.00 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,400	100	0.	0.	Initial load.
28,800	200	.0002	0.	
57,600	400	.0006	0.	
86,400	600	.0010	.0001	E=2,778,000 pounds per square inch.
115,200	800	.0013	.0002	
144,000	1,000	.0018	.0003	E=3,000,000 pounds per square inch.
172,800	1,200	.0023	.0004	
201,600	1,400	.0028	.0006	E=2,778,000 pounds per square inch.
230,400	1,600	.0033	.0008	
259,200	1,800	.0040	.0009	
288,000	2,000	.0044	.0011	
316,800	2,200	.0052	.0013	
345,600	2,400	.0060	.0016	
374,400	2,600	.0070	.0020	
403,200	2,800	.0082	.0025	
432,000	3,000	.0092	.0028	
460,800	3,200	.0115	.0039	
516,800	3,589	....	....	First crack and ultimate strength.

Marks, 171.
Composition: Alpha Portland cement. 1; sand, 3; ⅝" trap rock.
Water used in mortar, 72.8 per cent of cement.
Age, 1 year.
Weight per cubic foot, 139.6 pounds.
Sectional area, 144.00 square inches.
Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,400	100	0.	0.	Initial load.
28,800	200	.0002	0.	
57,600	400	.0007	.0001	
86,400	600	.0013	.0002	E=2,273,000 pounds per square inch.
115,200	800	.0022	.0006	
144,000	1,000	.0032	.0010	E=2,045,000 pounds per square inch.
172,800	1,200	.0050	.0019	
201,600	1,400	.0071	.0029	E=833,000 pounds per square inch.
230,400	1,600	.0093	.0042	
259,200	1,800	.0128	.0062	
288,000	2,000	.0185	.0108	
314,000	2,180	....	....	First crack and ultimate strength.

Marks, 181.
Composition: Alpha Portland cement, 1; sand, 4; ⅝" trap rock,
Water used in mortar, 104.8 per cent of cement.
Age, 1 year.
Weight per cubic foot, 138.3 pounds.
Sectional area, 144.36 square inches.
Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,436	100	0.	0.	Initial load.
28,872	200	.0003	0.	
43,308	300	.0008	.0001	
57,744	400	.0014	.0003	
72,180	500	.0021	.0007	
86,616	600	.0030	.0012	E=1,389,000 pounds per square inch.
101,052	700	.0041	.0019	
115,488	800	.0053	.0025	
129,924	900	.0073	.0038	
144,360	1,000	.0095	.0053	E=1,071,000 pounds per square inch.
158,796	1,100	.0118	.0073	
173,232	1,200	.0166	.0112	
187,668	1,300	.0208	.0138	
202,104	1,400	.0296	.0214	
215,800	1,495	....	....	First crack and ultimate strength.

Marks, 208.
Composition: Alpha Portland cement, 1; sand, 6; ⅝" trap rock, 12.
Water used in mortar, 146.7 per cent of cement.
Age, 1 year.
Sectional area, 144.48 square inches.
Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,448	100	0.	0.	This specimen had been loaded with 500 pounds per square inch compression before the micrometer observations were begun.
28,896	200	.0006	.0001	
43,344	300	.0012	.0001	
57,792	400	.0018	.0001	
72,240	500	.0026	.0005	
86,688	600	.0069	.0039	E=833,000 pounds per square inch.
101,136	700	.0139	.0104	
115,584	800	.0280	.0235	
124,300	860	....	....	First crack and ultimate strength.

The maximum load was sustained about 8 minutes, during which ne failure of the cube slowly progressed, gaining near the end of e test.

Marks, 387.
Composition: Alpha Portland cement, 1; sand, 2; 2½" trap rock, 7.
Water used in mortar, 69.3 per cent of cement.
Age, 1 year, 2 months.
Weight per cubic foot, 154.6 pounds.
Sectional area, 145.56 square inches.
Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,556	100	0.	0.	Initial load.
29,112	200	.0009	.0006	
43,668	300	.0018	.0012	
58,224	400	.0029	.0019	
72,780	500	.0038	.0025	
87,336	600	.0046	.0031	E=1,667,000 pounds per square inch.
101,892	700	.0055	.0037	
116,448	800	.0063	.0043	
131,004	900	.0074	.0049	
145,560	1,000	.0082	.0055	E=1,667,000 pounds per square inch.
174,672	1,200	.0100	.0069	
203,784	1,400	.0117	.0080	E=2,000,000 pounds per square inch.
232,896	1,600	.0135	.0091	
262,008	1,800	.0150	.0103	
291,120	2,000	.0162	.0110	
329,000	....	....	....	First crack.
376,200	2,584	....	....	Ultimate strength.

Marks, 479.
Composition: Alpha Portland cement, 1; sand, 4.
Water used in mortar, 48.7 per cent of cement.
Age, 1 year, 1 month.
Weight per cubic foot, 119.7 pounds.
Sectional area, 145.20 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,520	100	0.	0.	Initial load.
29,040	200	.0005	.0001	
43,560	300	.0010	.0001	
58,080	400	.0014	.0002	
72,600	500	.0018	.0003	
87,120	600	.0022	.0004	E=1,389,000 pounds per square inch.
101,640	700	.0026	.0006	
116,160	800	.0032	.0007	
130,680	900	.0036	.0009	
145,200	1,000	.0043	.0011	E=1,406,000 pounds per square inch.
174,240	1,200	.0058	.0016	
203,280	1,400	.0081	.0027	
222,000	1,529	....	....	First crack and ultimate strength.

Marks, 412.
Composition: Steel Portland cement, 1; sand, 2; 2½″ trap rock, 4.
Water used in mortar, 65.4 per cent of cement.
Age, 1 year, 2 months.
Weight per cubic foot, 152.4 pounds.
Sectional area, 144.24 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,424	100	0.	0.	Initial load.
28,848	200	.0015	.0012	
43,272	300	.0030	.0024	
57,696	400	.0044	.0036	
72,120	500	.0058	.0048	
86,544	600	.0074	.0061	E=1,923,000 pounds per square inch.
100,968	700	.0090	.0075	
115,392	800	.0109	.0091	
129,816	900	.0125	.0104	
144,240	1,000	.0142	.0118	E=1,875,000 pounds per square inch.
173,088	1,200	.0182	.0152	
201,936	1,400	.0227	.0192	
230,784	1,600	.0276	.0235	First crack.
297,000	2,059	....	....	Ultimate strength.

Marks, 475.
Composition: Alpha Portland cement, 1; sand, 3; 1½″ to 2½″ broken ick, 6.
Water used in mortar, 86.0 per cent of cement.
Age, 1 year, 1 month.
Weight per cubic foot, 125.9 pounds.
Sectional area, 144.60 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,460	100	0.	0.	Initial load.
28,920	200	.0004	.0001	
43,380	300	.0008	.0002	
57,840	400	.0012	.0004	
72,300	500	.0015	.0005	
86,760	600	.0019	.0007	E=2,083,000 pounds per square inch.
101,220	700	.0023	.0008	
115,680	800	.0026	.0010	
130,140	900	.0031	.0011	
144,600	1,000	.0036	.0013	E=1,956,000 pounds per square inch.
173,520	1,200	.0044	.0016	
202,440	1,400	.0056	.0021	
231,360	1,600	.0068	.0028	E=1,389,000 pounds per square inch.
260,280	1,800	.0085	.0036	
289,200	2,000	.0104	.0045	
318,120	2,200	.0136	.0063	First crack.
347,040	2,400	.0151	.0068	
355,000	2,455	....	....	Ultimate strength.

Marks, 440.
Composition: Norton's Rosendale cement, 1; sand, 2; 2½″ trap ck, 4.
Water used in mortar, 86.6 per cent of cement.
Age, 1 year, 2 months.
Weight per cubic foot, 147.6 pounds.
Sectional area, 144.60 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,460	100	0.	0.	Initial load.
28,920	200	.0022	.0018	
43,380	300	.0065	.0056	
57,840	400	.0119	.0106	
72,300	500	.0186	.0168	First crack.
86,760	600	.0258	.0233	
117,700	814	....	....	Ultimate strength.

Marks, 447.
Composition: Alpha Portland cement, 1; sand, 2; 1½" to 3" pebbles, 4.
Water used in mortar, 49.8 per cent of cement.
Age, 1 year, 2 months.
Weight per cubic foot, 148.8 pounds.
Sectional area, 144.96 square inches.
Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,496	100	0.	0.	Initial load.
28,992	200	.0002	0.	
43,488	300	.0005	.0002	
57,984	400	.0008	.0002	
72,480	500	.0011	.0004	
86,976	600	.0013	.0005	E.=3,125,000 pounds per square inch.
101,472	700	.0016	.0007	
115,968	800	.0019	.0007	
130,464	900	.0022	.0009	
144,960	1,000	.0024	.0009	E.=3,000,000 pounds per square inch.
173,952	1,200	.0031	.0011	
202,944	1,400	.0038	.0013	
231,936	1,600	.0045	.0016	E.=2,000,000 pounds per square inch.
260,928	1,800	.0053	.0019	
289,920	2,000	.0063	.0023	
318,912	2,200	.0071	.0024	
347,904	2,400	.0078	.0026	
376,896	2,600	.0093	.0032	
405,888	2,800	.0110	.0038	First crack.
434,880	3,000	.0135	.0051	
463,872	3,200	.0186	.0083	
492,864	3,400	....	....	Ultimate strength.

Marks, 461.
Composition: Alpha Portland cement, 1; sand, 2; 1½" to 2½" broken brick, 4.
Water used in mortar, 54.3 per cent of cement.
Age, 1 year, 2 months.
Weight per cubic foot, 130.6 pounds.
Sectional area, 144.72 square inches.
Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,472	100	0.	0.	Initial load.
28,944	200	.0002	0.	
43,416	300	.0004	.0001	
57,888	400	.0006	.0001	
72,360	500	.0008	.0002	
86,832	600	.0007	.0003	E=6,250,000 pounds per square inch.
101,304	700	.0013	.0004	
115,776	800	.0015	.0004	
130,248	900	.0019	.0005	
144,720	1,000	.0021	.0006	E=3,000,000 pounds per square inch.
173,664	1,200	.0029	.0009	
202,608	1,400	.0036	.0010	
231,552	1,600	.0041	.0011	E=1,923,000 pounds per square inch.
260,496	1,800	.0049	.0014	
289,440	2,000	.0058	.0017	
318,384	2,200	.0069	.0022	
347,328	2,400	.0083	.0030	
376,272	2,600	.0101	.0040	
405,216	2,800	.0119	.0050	
434,160	3,000	.0144	.0069	First crack.
463,104	3,200	.0195	.0107	
501,000	3,462	....	....	Ultimate strength.

CONCRETE CUBES

FROM

WILLIAM WIRT CLARKE AND SON.

COMPRESSIVE TESTS OF CONCRETE CUBES.

Made of Akron Star cement.
Specimens furnished by William Wirt Clarke & Son, Baltimore, Md.

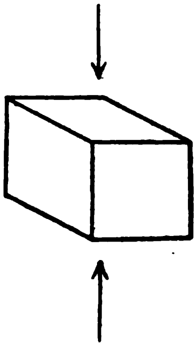
Marks.	Composition.				Age.	Dimensions.			Sectional area.	Weight, total.		Weight per cubic foot.	First crack.	Ultimate strength.	
	Cement.	Sand.	Gravel.	Stone.		Height.	Compressed surface.							Total.	Per square inch.
						Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Lbs.*	*ozs.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
No. 1	1	1½		4	30 days	12.12	12.34	12.08	149.07				215,000	217,200	1,457
No. 1	1	1½		4	do	12.17	12.28	12.10	148.59				216,000	219,400	1,477
No. 1	1	1½		4	do	12.10	12.42	12.03	149.41				191,000	210,900	1,412
No. 2	1	3		7½	do	12.05	12.30	12.17	149.69				147,000	148,200	990
No. 2	1	3		7½	do	12.13	12.20	12.04	146.89				153,000	160,600	1,093
No. 2	1	3		7½	do	12.12	11.90	12.08	143.75				181,000	142,300	990
No. 3	1	2	3	4	do	12.20	12.24	12.12	148.85				174,000	185,100	1,248
No. 3	1	2	3	4	do	12.12	12.20	12.00	146.40				161,000	166,200	1,135
No. 3	1	2	3	4	do	12.13	12.17	12.00	146.04				120,000	132,300	906
No. 4	1	2	7		do	12.00	12.18	12.10	147.38				110,000	115,500	784
No. 4	1	2	7		do	12.00	12.25	12.12	148.47				98,000	101,300	682
No. 4	1	2	7		do	11.96	12.20	12.11	147.74				103,000	114,000	772
No. 5	1	2¼	8		do	11.96	12.22	12.11	147.98				79,700	89,900	608
No. 5	1	2¼	8		do	12.15	12.03	12.45	149.77				104,200	112,000	748
No. 5	1	2¼	8		do	12.12	12.25	12.00	147.00				117,000	126,500	861
No. 1	1	1½		4	7 months	12.15	12.06	12.04	145.20	150	0	146.92	219,000	227,500	1,570
No. 1	1	1½		4	do	12.16	12.02	12.08	145.20	154	8	151.22	316,000	392,000	2,700
No. 1	1	1½		4	do	12.23	12.06	12.10	145.93	154	4	149.35	309,000	346,000	2,370
No. 2	1	3		7½	do	12.11	12.13	12.12	147.02	151	0	146.56	238,000	298,000	2,030
No. 2	1	3		7½	do	12.14	12.06	12.10	145.93	153	0	149.23	264,000	293,000	2,010
No. 2	1	3		7½	do	12.11	12.11	12.02	145.56	151	12	148.77	274,000	279,500	1,920
No. 3	1	2	3	4	do	11.92	12.12	12.14	147.14	154	4	151.98	302,000	332,600	2,260
No. 3	1	2	3	4	do	12.08	12.14	12.15	147.50	156	4	151.53	335,000	346,000	2,350
No. 3	1	2	3	4	do	12.15	12.02	12.12	145.68	154	4	150.59	281,000	281,000	1,930
No. 4	1	2	7		do	11.98	12.09	12.10	146.29	151	8	149.37	195,700	217,500	1,490
No. 4	1	2	7		do	11.98	12.12	12.13	147.02	147	4	144.47	164,500	186,600	1,270
No. 4	1	2	7		do	11.92	12.12	12.12	146.89	154	12	152.72	273,000	314,500	2,140

Compressive tests of concrete cubes—Continued.

Marks.	Composition.				Age.	Dimensions.			Sectional area.	Weight, total.	Weight per cubic foot.	First crack.	Ultimate strength.	
	Cement.	Sand.	Gravel.	Stone.		Height.	Compressed surface.						Total.	Per square inch.
						Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Lbs. ozs.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
No. 5	1	2¼	8	....	.....do....	12.12	12.14	12.04	146.17	154 12	150.94	187,400	189,500	1,300
No. 5	1	2¼	8	....	.....do....	12.12	12.13	12.05	146.17	155 8	151.68	228,600	228,600	1,560
No. 5	1	2¼	8	....	.....do....	12.10	12.13	12.14	147.26	153 4	148.62	218,500	259,100	1,760
No. 1	1	1⅛	....	4	1 year....	12.02	12.10	12.23	147.98	....	....	375,000	443,000	2,994
No. 1	1	1⅛	....	4	.....do....	12.11	12.21	12.09	147.62	....	....	295,000	351,000	2,378
No. 1	1	1⅛	....	4	.....do....	12.12	12.16	12.24	148.84	....	....	347,000	503,000	3,379
No. 2	1	3	....	7⅛	.....do....	12.16	12.09	12.22	147.74	....	....	261,000	289,000	1,956
No. 2	1	3	....	7⅛	.....do....	12.25	12.24	12.07	147.74	....	....	265,000	312,000	2,112
No. 2	1	3	....	7⅛	.....do....	12.17	12.10	12.21	147.74	....	....	301,000	319,000	2,159
No. 3	1	2	3	4	.....do....	12.09	12.20	12.18	148.60	....	....	319,000	321,000	2,160
No. 3	1	2	3	4	.....do....	12.01	12.07	12.19	147.13	....	....	281,000	286,500	1,947
No. 3	1	2	3	4	.....do....	12.33	12.22	12.07	147.50	....	....	295,000	321,000	2,176
No. 4	1	2	7	....	.....do....	12.04	12.22	12.16	148.60	....	....	....	255,700	1,721
No. 4	1	2	7	....	.....do....	12.19	12.20	12.07	147.25	....	....	....	269,500	1,830
No. 4	1	2	7	....	.....do....	12.09	12.07	12.21	147.37	....	....	....	268,900	1,825
No. 5	1	2¼	8	....	.....do....	12.20	12.02	12.23	147.00	....	....	....	235,300	1,601
No. 5	1	2¼	8	....	.....do....	12.19	12.08	12.03	145.32	....	....	....	210,100	1,446
No. 5	1	2¼	8	....	.....do....	12.05	12.22	12.16	148.60	....	....	....	192,800	1,297

CEMENT ROCK.

COMPRESSION TESTS OF CEMENT ROCK FROM WHICH NEWARK AND ROSENDALE CEMENT IS MADE.



Samples dressed on a rubbing bed.
There were seams present in each sample before testing.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
10392	Dark cement rock..	2.44	2.43	2.42	5.88	56,000	182,000	30,950
10393	Light cement rock .	2.18	2.20	2.18	4.80	166,000	196,200	40,875

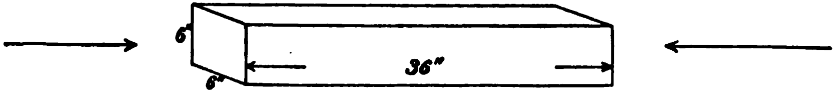
CONCRETE PRISMS

FROM

BOSTON TRANSIT COMMISSION.

COMPRESSION TESTS OF CONCRETE PRISMS.

Material submitted by Mr. H. A. Carson, chief engineer Boston transit commission.



Marks.	Brand of cement.	Composition.			Age.	Weight.			Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Cement.	Sand.	Stone.		Total.		Per cubic foot.	Height.	Compressed surface.				Total.	Per square inch.	
					Days.	*Lbs.*	*Ozs.*	*Lbs.*	*Inches.*	*In.*	*In.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
IIII	Vulcanite	1	2½	4-pebbles	38	107	.....	148.1	36.20	6.02	5.73	34.49	61,900	61,900	1,795	Size of pebbles, ¼" to 2" diameter.
V					36	106	.....	159.7	35.98	6.13	5.20	31.88	80,800	80,800	2,535	The concrete was mixed very wet.
VI					36	106	8	148.2	36.33	6.04	5.66	34.19	60,200	60,200	1,761	
VII					35	104	.....	147.0	36.25	5.98	5.64	33.73	101,800	101,800	3,018	
VIII					34	103	8	145.6	36.23	5.97	5.68	33.91	56,500	56,500	1,666	
IX					33	112	8	155.1	36.32	5.93	5.82	34.51	84,300	84,300	2,443	
X					32	111	.....	147.8	36.30	6.04	5.92	35.76	87,700	87,700	2,452	
XI					31	111	8	151.8	36.27	5.88	5.95	34.99	102,800	102,800	2,938	
G. 7	Vulcanite	1	2½	4-gravel	33	112	8	147.7	36.03	6.08	6.01	36.54	121,000	121,000	3,311	Coarse, sharp sand used.
G. 8					33	112	.....	146.3	36.02	5.98	6.14	36.72	126,600	126,600	3,448	Washed gravel, ¼" to 2½" diameter.
G. 9					33	112	.....	148.7	36.04	6.01	6.01	36.12	139,100	139,100	3,851	The concrete was machine mixed.
G. 10					33	111	12	148.0	36.00	5.96	6.09	36.24	120,900	120,900	3,336	Prisms buried in the ground 28 days.
G. 12					33	112	12	147.5	36.04	6.14	5.97	36.66	110,500	110,500	3,014	
G. 14					33	112	8	148.1	36.05	6.09	5.98	36.42	117,200	117,200	3,218	
S. 13	Vulcanite	1	2½	4-trap	33	112	.....	148.3	36.07	6.03	6.00	36.18	139,800	139,800	3,864	Coarse, sharp sand used.
S. 14					33	112	8	149.2	36.06	6.00	6.02	36.12	139,100	139,100	3,851	Hard trap rock, 1" to 2½" diameter.
S. 15					33	113	12	149.5	36.04	6.06	6.02	36.48	145,500	145,500	3,988	The concrete was machine mixed.
S. 16					33	112	8	149.2	36.02	6.09	5.94	36.17	140,900	140,900	3,895	Prisms buried in the ground 28 days.
S. 17					33	113	.....	149.8	36.02	6.05	5.98	36.18	137,000	137,000	3,787	
S. 18					33	114	.....	150.4	36.08	6.00	6.05	36.30	142,800	142,800	3,934	

ADHESIVE RESISTANCE OF STEEL BARS EMBEDDED IN CONCRETE.

Steel rods ½" × ½" embedded in concrete prisms 6" × 6" by 18" long. Material submitted by Mr. H. A. Carson, chief engineer Boston transit commission.

Test No.	Marks.	Brand of cement.	Age.	Depth rod is embedded.	Surface in contact.	Adhesive resistance.	
						Total.	Per square inch.
			Days.	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*
11416	P. 22	Vulcanite	30	2	4	1,170	296
11417	P. 41	....	30	4	8	1,335	167
11418	P. 42	....	30	4	8	920	115
11419	P. 61	....	30	6	12	920	77
11420	P. 62	....	30	6	12	2,850	237
11421	P. 81	....	30	8	16	1,860	116
11422	P. 82	....	30	8	16	3,920	245
11423	P. 101	....	30	10	20	5,100	255
11424	P. 102	....	31	10	20	5,920	296
11425	P. 121	....	31	12	24	5,870	245
11426	P. 122	....	30	12	24	4,720	197
11437	R. 8	....	30	8	16	3,850	241
11438	R. 10	....	30	10	20	5,830	292
11439	R. 12	....	30	12	24	8,560	357

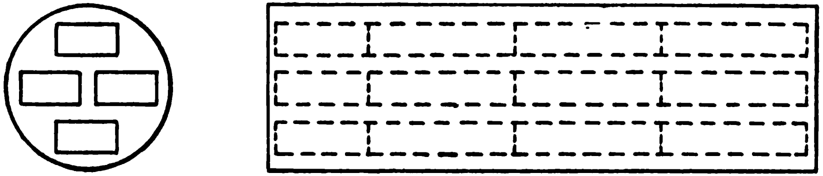
COMPRESSION TESTS OF THE CONCRETE PRISMS IN WHICH THE ½"×½" STEEL RODS WERE EMBEDDED, OF THE PRECEDING TESTS.

Test No.	Marks.	Brand of cement.	Age.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
				Height.	Compressed surface.				Total.	Per square inch.
			Days.	*Inches.*	*Inches.*	*Inches.*	*Sq. ins.*	*Pounds.*	*Pounds.*	*Pounds.*
11416 a	P. 22	Vulcanite ..	31	17.77	6.08	6.04	36.72	78,800	78,800	2,150
11417 a	P. 41	....	31	17.55	5.99	6.30	37.74	101,600	101,600	2,690
11418 a	P. 42	....	31	17.68	6.02	6.29	37.87	93,000	93,000	2,460
11419 a	P. 61	....	31	17.58	6.06	6.23	37.75	81,400	81,400	2,160
11420 a	P. 62	....	31	17.62	6.04	6.15	37.15	94,100	94,100	2,530
11421 a	P. 81	....	31	17.50	6.02	6.32	38.05	85,700	85,700	2,250
11422 a	P. 82	....	31	17.73	6.04	6.25	37.75	80,500	80,500	2,130
11423 a	P. 101	....	31	17.63	6.04	6.30	38.05	88,500	88,500	2,330
11424 a	P. 102	....	31	17.60	6.09	6.30	38.37	81,400	81,400	2,120
11425 a	P. 121	....	31	17.55	6.06	6.26	37.93	76,100	76,300	2,010
11426 a	P. 122	....	31	17.70	6.05	6.25	37.81	84,200	84,200	2,230
11437 a	R. 8	....	35	17.60	6.25	6.05	37.81	153,500	153,500	4,060
11438 a	R. 10	....	35	17.58	6.15	6.05	37.21	160,500	160,500	4,310
11439 a	R. 12	....	35	17.62	6.19	6.03	37.33	159,200	159,200	4,260

COMPRESSION TESTS OF CEMENT AND CEMENT MORTAR MOLDED AND RETAINED IN STOVEPIPES.

Material submitted by Mr. H. A. Carson, chief engineer Boston transit commission.

Sketch showing the disposition of bricks in specimens Nos. 17 and 18.



Test No.	Marks.	Brand of cement.	Composition.		Age.		Dimensions.		Sectional area.	Ultimate strength.		Remarks.
			Cement.	Sand.			Height.	Diameter.		Total.	Per square inch.	
					Mos.	*Days.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	
11442	15	Alsen	Neat.		3	16	30.47	8.19	52.68	231,000	4,380	
11443	16		Neat.		3	16	30.10	8.15	52.17	292,100	5,600	
11444	17		1	1	3	15	30.73	8.14	52.04	177,400	3,410	14 bricks, per sketch.
11445	18		1	1	3	15	30.18	8.16	52.30	198,200	3,790	Do.
11446	21		1	1	3	15	30.16	8.15	52.17	255,800	4,900	
11447	22		1	1	3	15	30.25	8.16	52.30	234,400	4,480	
11448	25		Neat.		3	9	28.16	5.93	27.62	254,100	9,200	Naked specimen.
11449	26		1	½	3	9	28.30	6.33	31.47	225,100	7,150	
11450	27		1	1	3	9	28.10	6.10	29.22	193,000	6,610	
11451	28		Neat.		3	6	28.35	6.10	29.22	212,400	7,270	
11452	29		Neat.		3	6	28.39	6.24	30.58	225,800	7,380	
11453	31		1	1	3	6	28.32	6.28	30.97	138,600	4,480	
11454	33		1	½	3	6	28.32	5.99	28.18	155,000	5,500	Do.

COMPRESSION TEST OF YELLOW PINE PUSH BARS EMBEDDED IN CONCRETE.

Material submitted by Mr. H. A. Carson, chief engineer, Boston transit commission.

The push bars were embedded in a cylindrical mass of concrete 10 feet long by 28 inches diameter in the following manner:

A cylindrical mold 10 feet long, the interior diameter of which was 28 inches, was placed on end, the bottom being closed with a bulkhead having a central aperture 5″ x 5,″ through which the end of the first yellow pine push bar was placed. This first push bar was centered within the mold and a section of concrete tamped about it, filling the mold a length of 2′ 6″. At the expiration of 8 hours a second push bar was placed upon the first bar and connected therewith by means of a cast-iron ribbed coupling and a second section of concrete 2′ 6″ long tamped in the mold. In like manner a third section of concrete and its push bar were added 16 hours after the first section was made, and a fourth section and push bar 24 hours after the first section was made. The upper end of the mold was closed with a bulkhead having a central opening 5″ x 5″ to accommodate the upper end of the fourth push bar. The concrete was then lowered into a horizontal position and adjusted in the testing machine, and about 1 hour later loads were applied to the column of push bars in the axis of the mold.

Under a load of compression of 102,500 pounds the fourth push bar, at the bulkhead or outer end, crushed at two knots about 4″ from the end of the stick. The knots were 1½″ and ¾″ in diameter. This load was the maximum resistance displayed. As the fibers were crushed. the load fell to about 77,600 pounds, at which time the test was discontinued and the material allowed to rest over night.

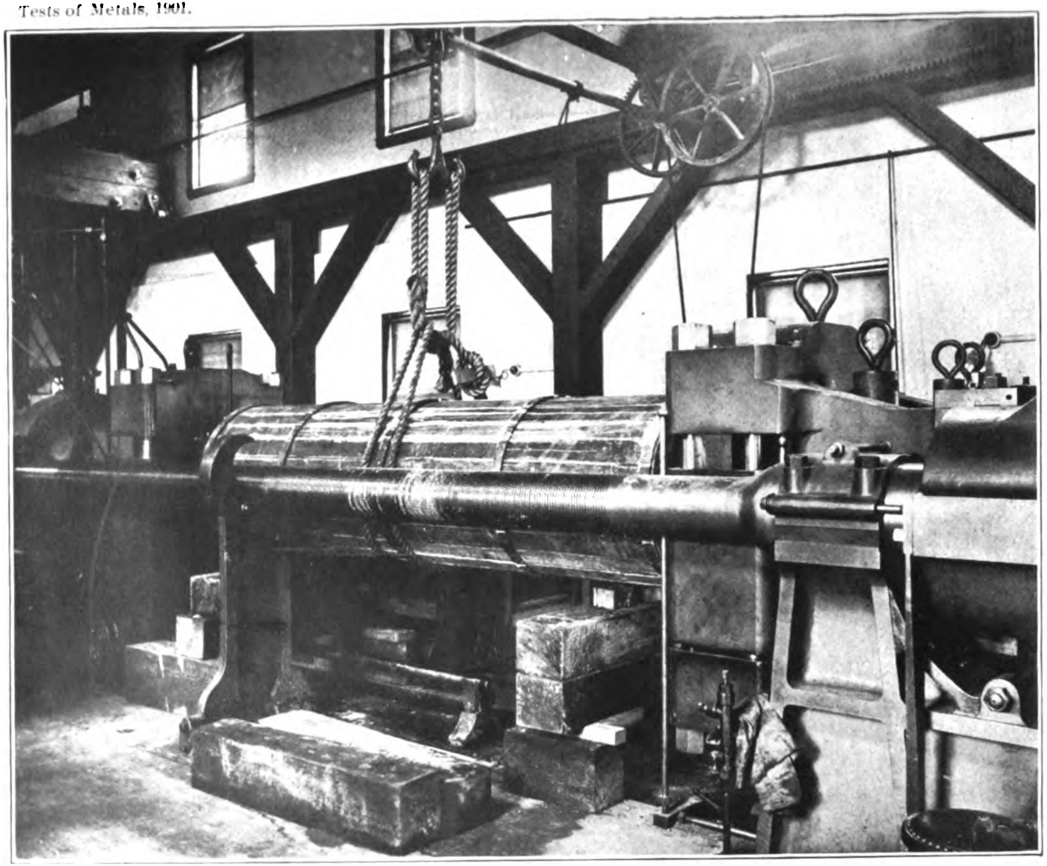
Renewing the load 14 hours later the end push bar continued to yield under the load of 77,600 pounds. The test was then discontinued and the material removed from the testing machine.

The mold was stripped from the concrete and the latter removed from the fourth and the third push bars. A slight movement of the coupling below the fourth bar appeared to have taken place in the direction of the axis of the specimen. The coupling below the third bar did not appear to have moved during the test.

A supplementary test was made with the fourth push bar. The injured portion was sawed off and the remaining part subjected to endwise compression, sides free. The bar was now 21⅜″ long, and it was immersed in water for 5 hours immediately preceding this test. Its ultimate strength was now found to be 111,600 pounds. Failure occurred at a knot ¾″ diameter, which was located 3½″ from the end of the bar.

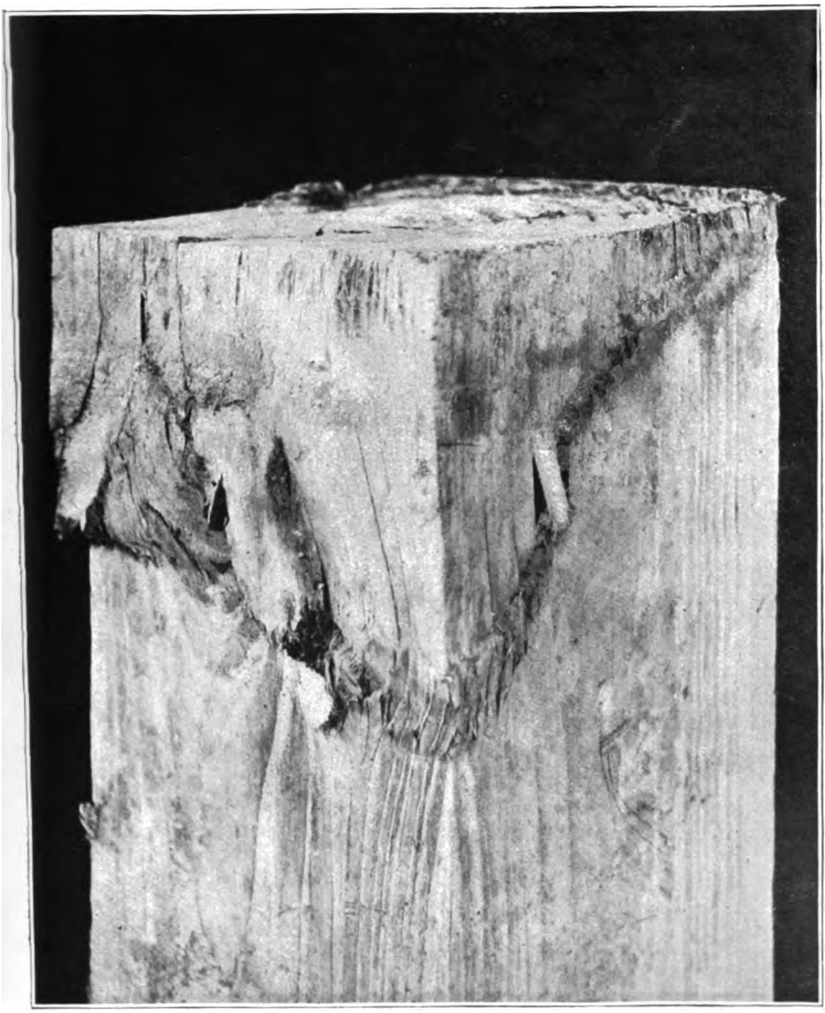
The composition of the concrete was Vulcanite cement 1, stone dust 2½, crushed stone 4½. The push bars had been soaked in water before being used in the test cylinder.

A photograph showing the test cylinder in the mold as it appeared in the testing machine, also a view of the original fractured end of the fourth push bar are shown herewith.



COMPRESSION TEST OF YELLOW-PINE PUSH BARS IMBEDDED IN CONCRETE.

Photograph showing the test cylinder in hooped and staved mold in the testing machine.

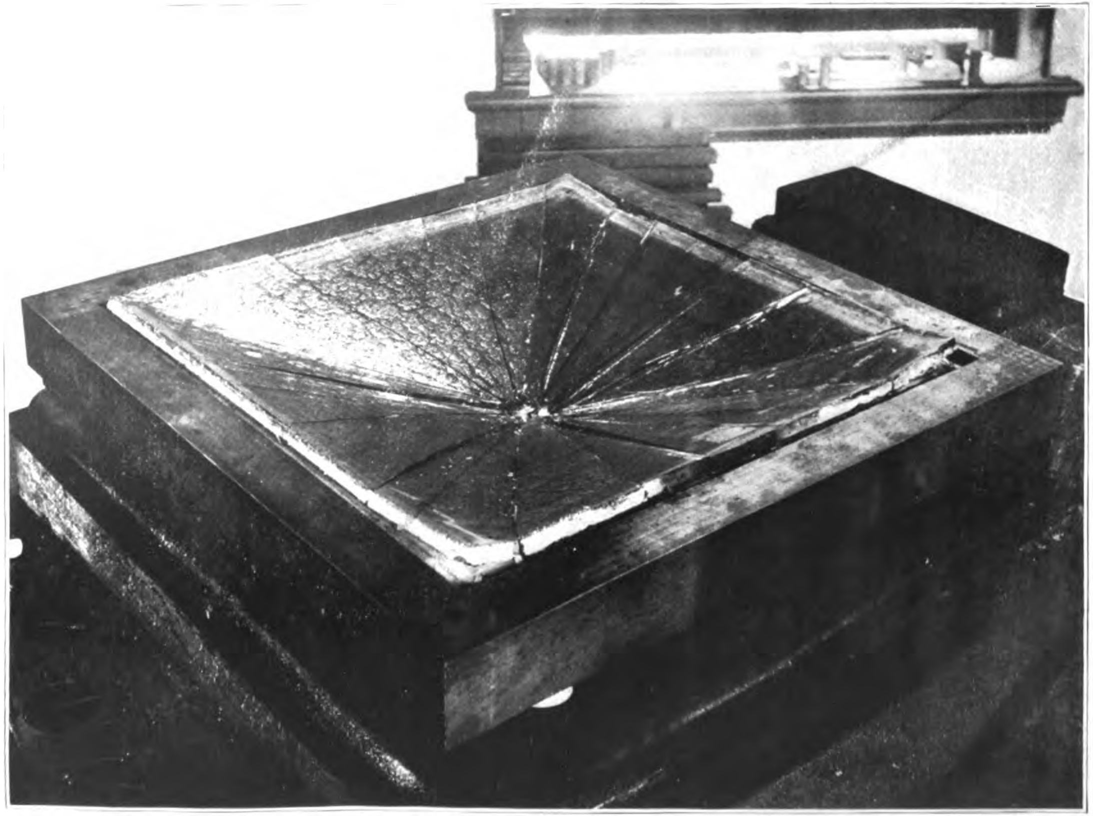


COMPRESSION TEST OF YELLOW-PINE, ETC.

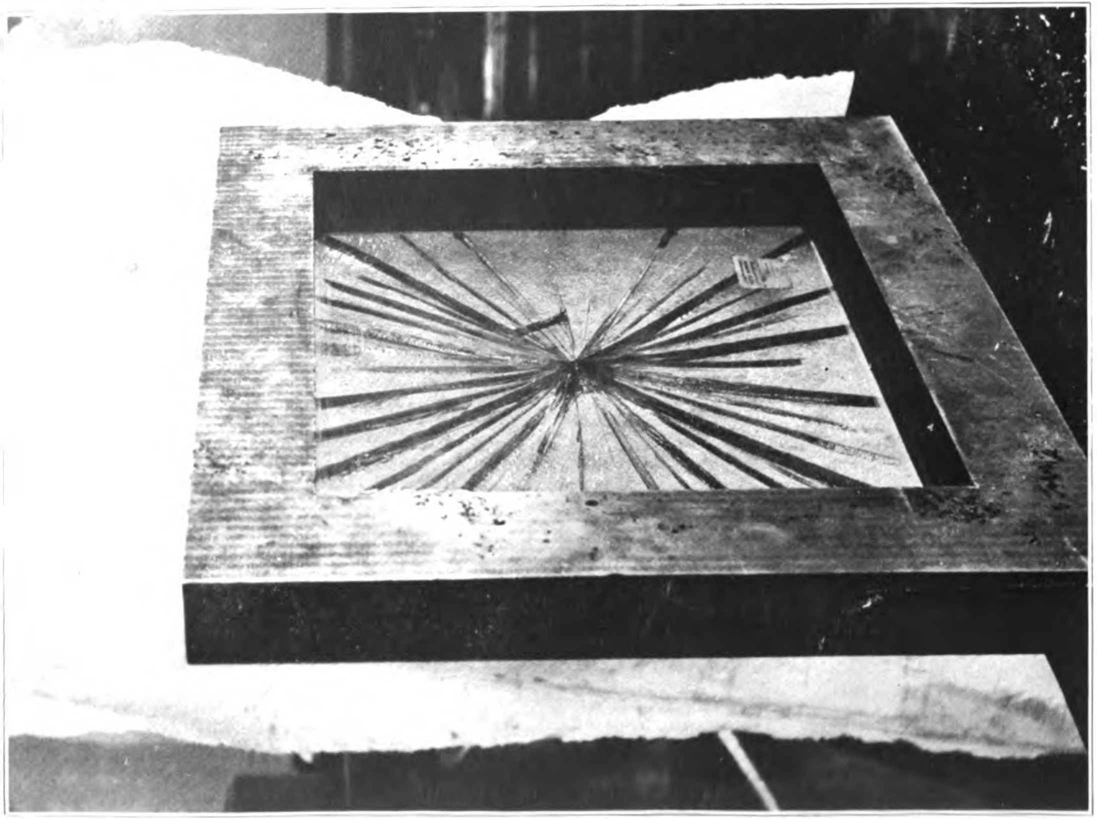
Photograph of the original fractured end of the fourth push bar, in the vicinity of knots.

STRENGTH OF GLASS.

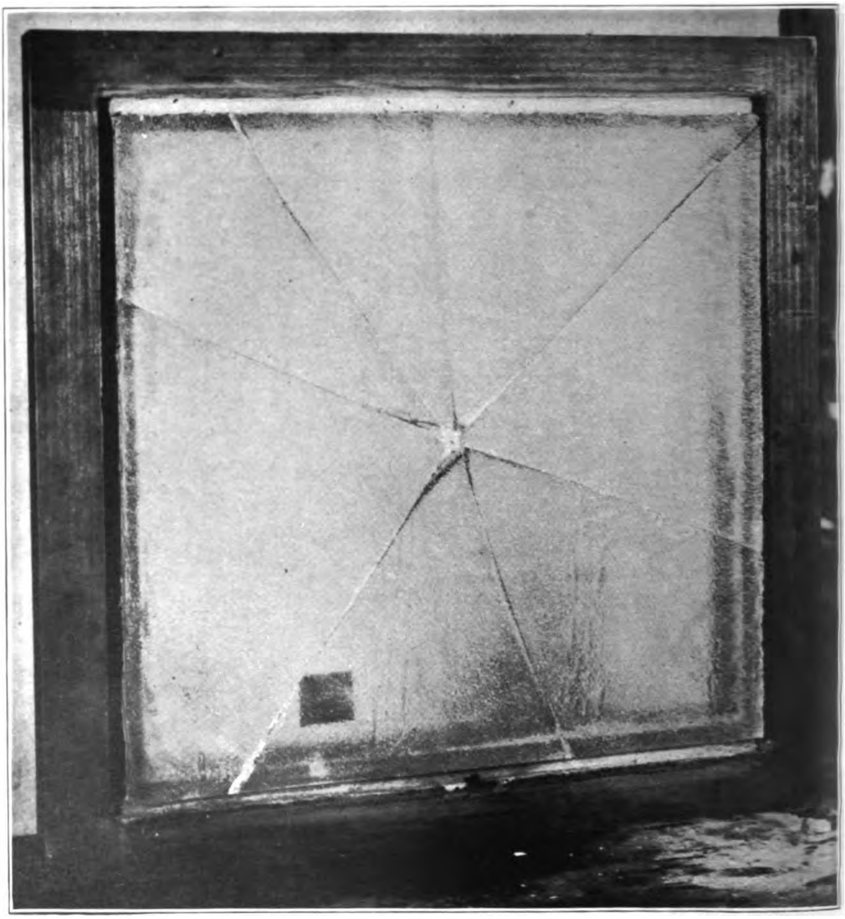
LIGHTS SET IN FRAMES, TRANSVERSE AND COMPRESSION TESTS.



PHOTOGRAPH OF 20 BY 20-INCH LIGHT OF ROUGH PLATE, ONE HALF INCH THICK, AFTER TESTING.
ULTIMATE STRENGTH, 905 POUNDS; 27 FRAGMENTS.



PHOTOGRAPH OF 16 BY 16-INCH LIGHT OF ROUGH PLATE, 1 INCH THICK AFTER TESTING. ULTIMATE STRENGTH, 5,490 POUNDS; 46 RADIAL LINES OF FRACTURE.



PHOTOGRAPH OF 20 BY 20-INCH LIGHT OF ROUGH PLATE, 1 INCH THICK, AFTER TESTING.
ULTIMATE STRENGTH, 2,110 POUNDS; 7 FRAGMENTS.

STRENGTH OF GLASS.

Two series of tests were made (1) with lights set in frames, bedded in neat Portland cement, (2) tranverse tests of lights supported across each end and loaded across the middle of the span, no cement being used with these specimens.

In the first series the lights were bedded and the cement allowed to set an interval of 24 hours before testing. Loads were applied at the middle of the lights by means of a cast-iron block measuring 2" x 2" in cross-section dimensions. Wet cardboard cushions were placed between the face of the cast-iron block and the light of glass. The central load required to break the glass is recorded as the strength of the material, the load being gradually increased until rupture occurred. The actual thickness of the glass varied somewhat from its nominal thickness. The figures over the ultimate strength give the actual thickness of each light.

The results taken as a whole show over what range the strength of the glass may be found. There are variations in the strength of lights of the same nominal thickness, which make it appear that the strength of this material varies in itself; in some cases a large light sustained a greater load than other lights of smaller dimensions.

It is observed that the strongest lights broke into the largest number of fragments. Generally the number of pieces ranged from 8 to 16. An exceptionally strong light was found in the rough plate 1" thick, 16" x 16" size, which displayed upon fracture 46 radial cracks

The tabulations of the results with square lights set in frames are followed by the details of the transverse tests, and then tables of comparisons based upon the preceding details.

The results of the transverse tests, in order to admit of direct comparison, are reduced by computation to pounds per square inch, and are given in the column headed "Modulus of rupture." The formula for this reduction in strength is as follows:

$R=\frac{3Pl}{2bd^2}$, in which R = modulus of rupture, pounds per square inch.

P = load.
l = length of specimen or span.
b = breadth of specimen.
d = depth of specimen.

In the first table of comparisons on rough plate from two factories it appears that in four thicknesses each factory shows the stronger glass in two cases. So far as concerns the strength of the glass with respect to thickness, the greater relative strength generally is found in the thinner lights.

In ribbed plate no practical difference is shown in the strength of the glass from the two factories represented.

In the wired plate in each case the sandwich rolled appears the stronger.

In the matter of annealing, one thickness is stronger in the oven-annealed plate, another thickness shows results in favor of Lehr annealing, while in a third thickness no practical difference is found. The method of annealing the thinner lights of this series is not known.

A comparison of the rough, ribbed, wired, and polished plate shows the wired plate below the strength of the other kinds of plate. With respect to the rough, ribbed, and polished plate, each in turn shows higher strength than the others.

Taking into consideration the variation in strength displayed by individual specimens the results of these comparisons will be accepted provisionally, the evidence not generally being of a conclusive nature. The relative strength of lights set in frames in which the four edges are supported, compared with the transverse tests, where the lights were supported along two edges, shows the strength of the lights in frames ranging from once to nearly twice the strength of the transverse specimens.

Under direct compression the crushing strength of glass was found to be very great, showing values from 45,040 to the enormous strength of 84,000 pounds per square inch.

LIGHTS SET IN FRAMES.

Factory.	Description.	Nominal thickness.	Ultimate strength, pounds.			
			8″ x 8″.	12″ x 12″.	16″ x 16″.	20″ x 20″.
		Inch.	Inch.	Inch.	Inch.	Inch.
Appert	Rough, Lehr annealed	1/8	.16 248	.10 93	.17 115	.16 104
	do	3/16	.21 272	.20 205	.20 211	.19 255
	do	1/4	.26 356	.27 513	.26 334	.30 402
	do	3/8	.43 1,197	.42 791	.36 467	.42 734
	do	1/2	.47 1,372	.50 1,376	.47 1,238	.47 [illegible]
Mississippi	do	1/8	.15 171	.15 143	.13 132	.13 103
	do	3/16	.22 309	.22 262	.22 184	.21 245
	do	1/4	.29 693	.27 267	.27 387	.28 364
	do	3/8	.37 878	.38 885	.35 580	.36 542
(Not known)	Rough, oven annealed	1/2	.52 1,740	.54 2,010	.50 1,290	.51 1,190
	do	3/4	.83 3,630	.82 3,640	.75 2,680	.80 2,120
	do	3/4	.81 3,110	.82 2,330	.75 2,260	.86 2,310
	do	1	.99 3,720	1.06 3,750	1.02 3,980	.95 2,840
	do	1	.97 3,110	.99 3,720	…… 5,490	1.00 2,110
Appert	Wired, Lehr annealed, sandwich rolled.	1/4	.28 347	.28 234	.29 234	.28 227
	do	3/8	.40 980	.41 774	.38 598	.40 552
	do	1/2	.54 1,590	.54 1,520	.53 1,210	.56 1,530
	do	1/2	.53 1,694	.54 1,134	.55 984	.52 [illegible]
Mississippi	Wired, solid rolled	1/4	.28 388	.31 352	.28 228	.31 [illegible]
	do	3/8	.38 898	.40 692	.38 436	[illegible]

NOTE.—The figures over the ultimate strength of each light of the several sizes give the act thickness of that light.

DETAILS OF TRANSVERSE TESTS.

Lights supported at the ends, loaded at the middle.

ROUGH PLATE. 24-INCH SPAN.

Factory.	Description.	Nominal thickness.	Dimensions.		Ultimate strength.		Deflection.
			Width.	Thickness.	Total.	Modulus of rupture per square inch.	
		Inch.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	*Inch.*
Appert	Lehr annealed	1/8	7.96	.13	22	5,890	.36
Mississippi	do	1/8	7.98	.15	39	7,820	.31
Appert	do	3/16	8.00	.20	59	6,640	.25
Mississippi	do	3/16	7.92	.21	51	5,260	.17
Appert	do	1/4	8.05	.26	112	7,410	.23
Mississippi	do	1/4	7.93	.30	125	6,310	.18
Appert	do	3/8	8.00	.37	145	4,770	.11
Mississippi	do	3/8	7.93	.37	177	5,870	.14
(Not known)	Oven annealed	1/2	7.98	.50	286	5,160	.10
	do	1/2	7.98	.51	244	4,240	.07
	do	3/4	7.97	.72	446	4,890	.05
	do	3/4	8.00	.72	552	6,030	.06
	do	1	7.97	1.01	908	4,020	.04
	do	1	7.94	1.07	946	3,750	.04

ROUGH PLATE. 16-INCH SPAN.

Appert	Lehr annealed	1/8	8.00	.14	28	4,290	.11
Mississippi	do	1/8	7.98	.15	40	5,350	.13
Appert	do	3/16	8.01	.20	83	6,220	.13
Mississippi	do	3/16	7.97	.22	97	6,030	.11
Appert	do	1/4	8.00	.28	88	3,900	.06
Mississippi	do	1/4	7.98	.26	121	5,380	.09
Appert	do	3/8	7.99	.39	294	5,810	.06
Mississippi	do	3/8	7.96	.39	258	5,110	.06
(Not known)	Oven annealed	1/2	8.00	.54	388	3,990	.03
	do	1/2	7.99	.56	330	3,160	.04
	do	3/4	7.94	.78	858	4,260	.02
	do	3/4	7.96	.78	949	4,700	.03
	do	1	7.96	.96	520	1,700	....
	do	1	7.95	.95	1,160	3,880	....

ROUGH PLATE. 8-INCH SPAN.

Appert	Lehr annealed	1/4	8.00	.21	163	5,550	....
	do	1/4	7.98	.25	217	5,220	....
Mississippi	do	1/4	8.01	.22	197	6,100	....
	do	1/4	7.95	.24	254	6,660	....
Appert	do	3/8	8.02	.39	650	6,390	....
Mississippi	do	3/8	7.97	.38	498	5,200	....
(Not known)	Oven annealed	1/2	7.95	.56	556	2,680	....
	do	1/2	7.98	.53	432	2,310	....
	do	3/4	7.97	.72	1,410	4,100	....
	do	3/4	7.98	.72	1,240	3,600	....
	do	1	7.99	1.04	1,810	2,510	....
	do	1	7.95	.99	1,730	2,660	....

RIBBED PLATE. 24-INCH SPAN.

Appert	Lehr annealed	1/8	8.01	.15	24	4,790	.28
Mississippi	do	1/8	7.95	.15	28	5,630	.35
Appert	do	1/4	8.00	.27	111	6,850	.21
Mississippi	do	1/4	7.95	.27	111	6,890	.21
Appert	do	3/8	7.99	.39	174	5,160	.11
Mississippi	do	3/8	7.97	.38	168	5,250	.11

RIBBED PLATE. 16-INCH SPAN.

Factory.	Description.	Nominal thickness.	Dimensions.		Ultimate strength		Deflection.
			Width.	Thickness.	Total.	Modulus of rupture per square inch.	
		Inch.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	*Inch.*
Appert	Lehr annealed	1/8	8.00	.15	42	5,600	.15
Mississippi	.....do	1/8	7.99	.15	39	5,210	.16
Appert	.....do	1/4	8.00	.27	132	5,480	.08
Mississippi	.....do	1/4	7.95	.27	121	5,010	.07
Appert	.....do	3/8	7.99	.38	289	6.010	.07
Mississippi	.....do	3/8	7.97	.36	230	5,340	.06

RIBBED PLATE. 8-INCH SPAN.

Factory.	Description.	Nominal thickness.	Width.	Thickness.	Total.	Modulus of rupture per square inch.	Deflection.
Appert	Lehr annealed	1/4	8.00	.29	331	5,900	....
Mississippi	.....do	1/4	8.00	.28	283	5,410	....
Appert	.....do	3/8	8.00	.39	448	4,420	....
Mississippi	.....do	3/8	7.97	.37	645	7.100	....

POLISHED PLATE. 24-INCH SPAN.

Factory.	Description.	Nominal thickness.	Width.	Thickness.	Total.	Modulus of rupture per square inch.	Deflection.
Pittsburg	Lehr annealed	1/8	8.03	.09	11	6,090	.45
	Oven annealed	1/8	8.00	.12	26	8,120	.42
Toledo	Lehr annealed	3/16	7.98	.17	43	6,710	.34
	Oven annealed	3/16	8.03	.18	49	6,780	.30
Toledo	Lehr annealed	1/4	8.09	.24	72	5,560	.20
	Oven annealed	1/4	8.01	.25	56	4,030	.14
Pittsburg	.....do	1/2	8.01	.50	313	5,630	.10
	.....do	1/2	8.01	.50	280	5,040	.09
Pittsburg	.....do	3/4	8.05	.75	809	6,440	.08
	.....do	3/4	8.02	.73	745	6,280	.08
Pittsburg	.....do	1	8.00	1.01	972	4,290	.04
	.....do	1	8.02	.99	1,072	4,910	.05

POLISHED PLATE. 16-INCH SPAN.

Factory.	Description.	Nominal thickness.	Width.	Thickness.	Total.	Modulus of rupture per square inch.	Deflection.
Pittsburg	Lehr annealed	1/8	8.04	.09	19	7,000	.21
	Oven annealed	1/8	8.05	.13	41	7,240	.20
	Lehr annealed	3/16	8.05	.17	70	7,220	.17
	Oven annealed	3/16	8.00	.17	70	7,270	.15
	Lehr annealed	1/4	8.05	.21	89	6,020	.10
	Oven annealed	1/4	8.02	.24	106	5,510	.09
	Lehr annealed	1/2	8,02	.45	286	4,240	.06
	Oven annealed	1/2	8.02	.45	379	5,600	.05
	.....do	3/4	8.02	.76	855	4,430	.03
	.....do	3/4	8.03	.75	1,081	5,740	.03
	.....do	1	8.05	.96	820	2,650	....
	.....do	1	8.00	.98	1,510	4,720	....

POLISHED PLATE. 8-INCH SPAN.

Factory.	Description.	Nominal thickness.	Width.	Thickness.	Total.	Modulus of rupture per square inch.	Deflection.
Pittsburg	Lehr annealed	1/8	8.04	.09	30	5,530	....
	Oven annealed	1/8	8.04	.15	80	5,310	....
Toledo	Lehr annealed	1/4	8.00	.22	195	6,040	....
	Oven annealed	1/4	8.02	.25	217	5,200	....
Pittsburg	.....do	1/2	8.01	.50	825	4,940	....
	.....do	1/2	8.03	.49	904	5,630	....
	Lehr annealed	3/4	8.03	.73	1,320	3,700	....
	.....do	3/4	8.03	.73	2,310	6,480	....
	.....do	1	8.03	1.05	2,420	8,290	....
	.....do	1	7.98	1.03	4,580	6,500	....

WIRED PLATE, LEHR ANNEALED. 24-INCH SPAN.

Factory.	Description.	Nominal thickness.	Dimensions.		Ultimate strength.		Deflection.
			Width.	Thickness.	Total.	Modulus of rupture per square inch.	
		Inch.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	*Inch.*
Appert	Sandwich rolled	1/4	8.00	.28	88	5,050	.15
Mississippi	Solid rolled	1/4	7.96	.29	90	4,840	.15
Appert	Sandwich rolled	3/8	7.95	.37	137	4,530	.10
Mississippi	Solid rolled	3/8	8.00	.35	101	3,710	.10
Appert	Sandwich rolled	1/2	7.95	.54	301	4,670	.08
	do	1/2	8.00	.56	288	4,130	.07

WIRED PLATE, LEHR ANNEALED. 16-INCH SPAN.

Factory.	Description.	Nominal thickness.	Width.	Thickness.	Total.	Modulus of rupture per square inch.	Deflection.
Appert	Sandwich rolled	1/4	8.00	.30	126	4,200	.04
Mississippi	Solid rolled	1/4	7.99	.32	125	3,670	.06
Appert	Sandwich rolled	3/8	8.00	.40	225	4,220	.05
Mississippi	Solid rolled	3/8	7.95	.40	192	3,620	.04
Appert	Sandwich rolled	1/2	7.98	.55	386	3,840	.03
	do	1/2	7.99	.53	375	4,010	.03

WIRED PLATE, LEHR ANNEALED. 8-INCH SPAN.

Factory.	Description.	Nominal thickness.	Width.	Thickness.	Total.	Modulus of rupture per square inch.	Deflection.
Appert	Sandwich rolled	1/4	8.00	.26	247	5,480	....
Mississippi	Solid rolled	1/4	7.99	.31	192	3,000	....
Appert	Sandwich rolled	3/8	7.96	.38	468	4,880	....
Mississippi	Solid rolled	3/8	7.99	.39	469	4,630	....
Appert	Sandwich rolled	1/2	8.00	.54	717	3,690	....
	do	1/2	8.00	.55	890	4,410	....

TRANSVERSE TESTS.

Lights supported at the ends, loaded at the middle.
Comparison of strength of glass from different factories.

ROUGH PLATE. 24-INCH SPAN.

Nominal thickness.	Modulus of rupture per square inch.			The stronger glass.
	Appert.	Mississippi.	Mean.	
	Pounds.	*Pounds.*	*Pounds.*	
1/4 inch	5,890	7,820	6,855	Mississippi.
5/16 inch	6,640	5,260	5,950	Appert.
3/8 inch	7,410	6,310	6,860	Do.
1/2 inch	4,770	5,870	5,320	Mississippi.
5/8 inch	5,160	4,240	4,700	Factory not known.
3/4 inch	4,890	6,030	5,460	
1 inch	4,020	3,750	3,885	

RIBBED PLATE. 24-INCH SPAN.

Thickness.	Modulus of rupture per square inch.		The stronger glass.
	Appert factory.	Mississippi factory.	
	Pounds.	*Pounds.*	
1/4 inch	4,790	5,630	Mississippi.
3/8 inch	6,850	6,890	No practical difference.
1/2 inch	5,150	5,250	Very little difference.

Comparison of strength for different methods of manufacture.

WIRED PLATE. 24-INCH SPAN.

Thickness.	Modulus of rupture per square inch.		The stronger glass.
	Sandwich rolled.	Solid rolled.	
	Pounds.	*Pounds.*	
¼ inch	5,050	4,840	Sandwich.
⅜ inch	4,530	3,710	Do.
½ inch	4,670	4,130	Both sandwich rolled.

WIRED PLATE. 16-INCH SPAN.

Thickness.	Sandwich rolled.	Solid rolled.	The stronger glass.
¼ inch	4,200	3,670	Sandwich.
⅜ inch	4,220	3,620	Do.
½ inch	3,840	4,010	Both sandwich rolled.

Comparison of strength for different methods of annealing.

POLISHED PLATE. 24-INCH SPAN.

Thickness.	Modulus of rupture per square inch.		The stronger glass.
	Oven annealed.	Lehr annealed.	
	Pounds.	*Pounds.*	
¼ inch	8,120	6,090	Oven.
5/16 inch	6,780	6,710	No practical difference.
⅜ inch	4,030	5,560	Lehr.
½ inch	5,040	5,630	All oven annealed.
¾ inch	6,280	6,440	
1 inch	4,910	4,290	

Comparison of strength of the different kinds of plate.

24-INCH SPAN.

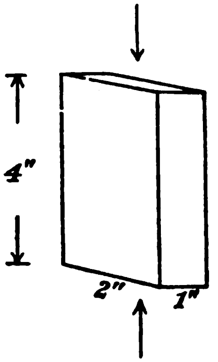
Thickness.	Modulus of rupture per square inch.								The strongest glass.
	Rough.		Ribbed.		Wired.		Polished.		
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
¼ inch ...	7,410	6,310	6,850	6,890	5,050	4,840	5,560	4,030	Ribbed.
⅜ inch ...	4,770	5,870	5,150	5,250	4,530	3,700	....	....	Rough.
½ inch ...	5,160	4,240	....	....	4,670	4,130	5,630	5,040	Polished.

Comparison of strength of lights set in square frames and having a bearing along each edge, with similar lights transversely loaded, which were supported at two opposite edges only.

Description.	Thickness.	Total ultimate strength.		Ratio of strength.
		In frames 16″ x 16″.	Transverse tests, 16″ wide by 16″ span.	
	Inch.	*Pounds.*	*Pounds.*	
Rough plate	1/8	123	68	1.9
	3/16	197	180	1.1
	1/4	360	209	1.7
	3/8	523	552	.95
	1/2	1,264	718	1.8
	3/4	2,470	1,807	1.4
Wired plate	1/4	231	251	.9
	3/8	517	417	1.2
	1/2	1,097	761	1.4

For the above comparison of strength, the results of the two transverse specimens 8″ wide, each, are added together and placed against the mean of two tests of 16″ x 16″ lights in frames.

COMPRESSION TESTS.



Nominal dimensions.

Description.	Dimensions.			Sectional area.	Ultimate strength.	
	Height.	Compressed surface.			Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*
Rough plate	3.81	0.98	2.02	1.98	102,500	51,770
	3.90	.99	2.02	2.00	155,400	77,700
Polished plate	4.08	1.07	2.04	2.18	98,200	45,040
	4.00	1.08	2.04	2.20	184,800	84,000

Transverse tests of glass from Watertown Arsenal storehouse. Double thick, blown glass.

Dimensions.		Span.	Ultimate strength.	
Width.	Thickness.		Total.	Modulus of rupture per square inch.
Inches.	*Inch.*	*Inches.*	*Pounds.*	*Pounds.*
8	0.105	8	49	6,670
7.97	.122	8	68	6,880
7.95	.103	16	27	7,680
7.95	.112	16	20	4,810
7.96	.116	24	20	6,720
7.98	.120	24	20	6,270

Glass from the Watertown, Mass., public library, stack floor. Rough glass set on rectangular iron frames.

Loads applied at the center on an iron follower 2″ x 2″ with ¼″ thickness of wet cardboard cushion.

Dimensions of glass.			Dimensions of frames, in the clear.		Ultimate strength.	No. of fragments.
Length.	Width.	Thickness.	Length.	Width.		
Inches.	*Inches.*	*Inch.*	*Inches.*	*Inches.*	*Pounds.*	
35.50	17.75	0.50	34.60	17	514	7
35.40	10.75	.59	34.60	9.88	757	4
31.30	17.90	.51	30.30	17	547	6
19.65	17.75	.43	18.65	17	469	8

Tested with the smooth surface of the glass uppermost.

ENDURANCE OF ROTATING SHAFTS.

Gautire steel.
Marks, $1C_2$.
Turned down from rod 1¼" diameter, 0.16 per cent carbon.
Diameter, 1"; speed of rotation, 500 per minute.
Length between end bearings, 33".
Loaded over 4" length at middle.
Deflections measured on chord of 10".

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	a	.1262	.0940	.1261	.0321	.0001	
	....	....	b	.1263	.0943	.1262	.0319	.0001	
	....	....	c	.1265	.0945	.1264	.0319	.0001	
	1,000	1,000	a	.1261	.0935	.1259	.0324	.0002	
	....	....	b	.1265	.0936	.1257	.0321	.0008	
	....	....	c	.1265	.0938	.1262	.0324	.0008	
	9,000	10,000	a	.1252	.0917	.1249	.0332	.0008	
	....	....	b	.1260	.0921	.1248	.0327	.0012	
	....	....	c	.1278	.0914	.1250	.0336	.0028	
	....	160,900	......	......	......	......	......	....	Rested 16 hours.
	150,900	160,900	a	.1220	.0895	.1222	.0327	−.0002	
	....	....	b	.1313	.0963	.1289	.0326	.0024	
	....	....	c	.1265	.0937	.1257	.0320	.0008	
	....	362,100	......	......	......	......	......	....	Rested 63 hours.
	201,200	362,100	a	.1306	.0956	.1280	.0324	.0026	
	....	....	b	.1215	.0878	.1207	.0329	.0008	
	....	....	c	.1290	.0955	.1270	.0315	.0020	
	112,200	474,300	......	......	......	......	......	....	Shaft ruptured ".8 north of south middle bearing.

METAL FROM ROTATING SHAFTS.

ENDURANCE TESTS.

TENSILE TESTS OF SPECIMENS TAKEN FROM THE OUTER ENDS OF SHAFTS WHICH WERE RUPTURED BY REPEATED STRESSES.

No. 7380.

Marks, 1 C 2.
Endurance test No. 304. See Report 1899, p. 855.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000067	.000067	0.	0.	
10,000	.000300	.000233	....	....	
20,000	.000633	.000333	....	....	
30,000	.000967	.000334	....	....	
40,000	.001333	.000366	0.	0.	
44,000	.001500	.000167	....	....	Elastic limit.
45,000	.028667	.027167	....	....	
46,000	.032167	.003500	....	....	
47,000	.034000	.001833	....	....	
48,000	.038000	.004000	....	....	
50,000	.045833	.007833	....	....	
52,000	.053	.007	....	....	
54,000	.063	.010	....	....	
56,000	.080	.017	....	....	
58,000	.097	.017	....	....	
60,000	.127	.030	....	....	
62,000	.193	.066	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	62,000
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.3333
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.214
Reduction in area after rupture, per cent of original section		61.5
Position of rupture		at the middle of the stem
Character of broken surface		fine silky, cup-shaped
Elongation of inch sections		″.22 ″.56*, ″.22

No. 7368.

Marks, 5 C 2.
Endurance test, No. 305.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads, per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000367	.000267	....	....	
20,000	.000767	.000400	....	....	
30,000	.001300	.000533	.000100	.000100	
40,000	.001667	.000367	.000133	.000033	
50,000	.002000	.000333	.000200	.000067	
58,000	.002300	.000300	....	....	Elastic limit (not well defined).
59,000	.002433	.000133	....	....	
60,000	.002933	.000500	.000933	.000733	
61,000	.006667	.003734	....	....	
62,000	.007000	.000333	....	....	
64,000	.008000	.001000	....	....	
68,000	.010400	.002400	....	....	
72,000	.012667	.002267	....	....	
76,000	.015100	.002433	....	....	
80,000	.017333	.002233	....	....	
84,000	.020733	.003400	....	....	
88,000	.023833	.003100	....	....	
92,000	.027333	.003500	....	....	
96,000	.033	.006	....	....	
100,000	.040	.007	....	....	
104,000	.043	.003	....	....	
108,000	.053	.010	....	....	
112,000	.063	.010	....	....	
117,400	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section..................................pounds.. 117,4
Elastic limit per square inch of original section (not well defined)........................do... 58,00
Elongation per inch after rupture..inch.. .33
Elongation per inch under strain at elastic limit..do... .0023
Reduction in diameter at point of rupture..do... .04
Reduction in area after rupture, per cent of original section.................................. 22.4
Position of rupture.. ″.8 from nec
Character of broken surface .... fine granular, radiating from cent
Elongation of inch sections.. ″.19, ″.12, ″.0

No. 7381.

Marks, 3 C 2.
Endurance test, No. 306. See Report 1899, p. 855.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
40,000	.001367	.000367	0.	0.	
49,000	.001633	.000265	....	....	Elastic limit.
50,000	.016000	.014367	....	....	
51,000	.017067	.001067	....	....	
52,000	.017667	.000600	....	....	
53,000	.018600	.000933	....	....	
54,000	.020000	.001400	....	....	
56,000	.023000	.003000	....	....	
58,000	.025333	.002333	....	....	
60,000	.028333	.003000	....	....	
62,000	.033	.005	....	....	
64,000	.040	.007	....	....	
68,000	.047	.007	....	....	
72,000	.060	.013	....	....	
76,000	.077	.017	....	....	
80,000	.120	.043	....	....	
82,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	82,000
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2733
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1".6 from neck
Character of broken surface		fine silky
Elongation of inch sections		".17, ".43*, ".20

No. 7369.

Marks, 2 C 2.
Endurance test No. 307. See Report, 1899, p. 855.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000133	.000133	0.	0.	
10,000	.000333	.000200	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
40,000	.001333	.000333	0.	0.	
48,000	.001633	.000300	....	....	Elastic limit.
49,000	.027000	.025367	....	....	
50,000	.028300	.001300	....	....	
52,000	.031667	.003367	....	....	
54,000	.036000	.004333	....	....	
56,000	.041167	.005167	....	....	
60,000	.054667	.013500	....	....	
64,000	.077	.022	....	....	
68,000	.103	.026	....	....	
71,520	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section .... pounds.. 71,52
Elastic limit per square inch of original section .... do... 48,00
Elongation per inch after rupture .... inch.. .304
Elongation per inch under strain at elastic limit .... do... .00163
Reduction in diameter at point of rupture .... do... .2
Reduction in area after rupture, per cent of original section .... 59.
Position of rupture .... 1″.45 from nec
Character of broken surface .... fine silky, cup shape
Elongation of inch sections .... ″.18, ″.44, ″.2

No. 7366.

Marks, $^{7\times1}_{1}$

Endurance test No. 311. See Report, 1899, p. 855.

Diameter, ″.564.

Sectional area, .25 square inch.

Gauged length, 3″.

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000633	.000333	....	....	
30,000	.000967	.000334	....	....	
40,000	.001300	.000333	0.	0.	
50,000	.001633	.000333	....	....	
58,000	.001900	.000267	....	....	
59,000	.018967	.017067	....	....	Elastic limit.
60,000	.020500	.001533	....	....	
62,000	.022333	.001833	....	....	
64,000	.026333	.004000	....	....	
68,000	.033667	.007334	....	....	
72,000	.043833	.010166	....	....	
76,000	.055667	.011834	....	....	
80,000	.080	.024	....	....	
85,360	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section ....pounds..	85,360
Elastic limit per square inch of original section ....do...	59,000
Elongation per inch after rupture ....inch..	.2633
Elongation per inch under strain at elastic limit ....do...	.018967
Reduction in diameter at point of rupture........do...	.204
Reduction in area after rupture, per cent of original section	59.3
Position of rupture	1″.54 from neck
Character of broken surface........	fine silky, cup shaped
Elongation of inch sections........	″.21, ″.43*, ″.15

No. 7367.

Marks, $^{7\times1}_{7}$

Endurance test No. 317. See Report 1900, p. 1133.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	0.	0.	
10,000	.000300	.000200	....	....	
20,000	.000667	.000367	....	....	
30,000	.001000	.000333	....	....	
40,000	.001333	.000333	0.	0.	
50,000	.001700	.000367	....	....	
55,000	.001900	.000200	0.	0.	
60,000	.002067	.000167	0.	0.	
65,000	.002267	.000200	....	....	Elastic limit.
66,000	.017667	.015400	....	....	
67,000	.019667	.002000	....	....	
68,000	.021000	.001333	....	....	
70,000	.024000	.003000	....	....	
72,000	.027000	.003000	....	....	
76,000	.034167	.007167	....	....	
80,000	.043333	.009166	....	....	
84,000	.060	.017	....	....	
88,000	.083	.023	....	....	
91,040	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,
Elastic limit per square inch of original section	do...	65,
Elongation per inch after rupture	inch..	.3
Elongation per inch under strain at elastic limit	do...	.002
Reduction in diameter at point of rupture	do...	.
Reduction in area after rupture, per cent of original section		6
Position of rupture		1".2 from
Character of broken surface		fine silky, cu
Elongation of inch sections		".13, ".30, "

No. 7382.

Marks, $^{7\times1}_{9}$
Endurance test No. 318. See Report 1900, p. 1134.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	0.	0.	0.	0.	Initial load.
5,000	.000100	.000100	....	....	
10,000	.000333	.000233	....	....	
20,000	.000667	.000334	....	....	
30,000	.001000	.000333	....	....	
40,000	.001367	.000367	0.	0.	
48,000	.001667	.000300	....	....	
49,000	.001700	.000033	....	....	Elastic limit (not well defined).
50,000	.001767	.000067	.000067	.000067	
51,000	.001900	.000133	....	....	
52,000	.002033	.000133	....	....	
53,000	.002167	.000134	....	....	
54,000	.002300	.000133	....	....	
55,000	.002400	.000100	.000400	.000333	
56,000	.002633	.000233	....	....	
58,000	.004000	.001367	....	....	
60,000	.008000	.004000	....	....	
64,000	.012167	.004167	....	....	
68,000	.016667	.004500	....	....	
72,000	.022667	.006000	....	....	
76,000	.028333	.005666	....	....	
80,000	.037	.009	....	....	
84,000	.050	.013	....	....	
88,000	.063	.013	....	....	
92,000	.097	.034	....	....	
94,320	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,320
Elastic limit per square inch of original section (not well defined)	do...	49,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.204
Reduction in area after rupture, per cent of original section		59.3
Position of rupture		1".3 from neck
Character of broken surface		fine silky, cup shaped
Elongation of inch sections		".13, ".34*, ".27

TABULATION OF TESTS OF SPECIMENS TAKEN FROM THE OUTER ENDS OF SHAFTS WHICH WERE RUPTURED BY REPEATED STRESSES.

Endurance test No.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	Inches.	*Sq.inch.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		" " "
304	.564	.25	44,000	62,000	33.3	61.5	Fine, silky	.22, .56*, .22
305	.564	.25	58,000	117,400	13.3	21.4	Granular......	.19*, .12, .09
306	.564	.25	49,000	82,000	27.3	54.6	Fine, silky	.17, .43*, .22
307	.564	.25	48,000	71,520	30.0	59.3	.....do.........	.18, .44*, .28
311	.564	.25	59,000	85,360	26.3	59.3	.....do.........	.21, .43*, .15
817	.564	.25	65,000	91,040	24.3	61.5	.....do.........	.13, .30*, .30*
318	.564	.25	49,000	94,320	24.7	59.3	.....do.........	.13, .34*, .27*

SILK CARTRIDGE CLOTH FOR NEW YORK ARSENAL.

Two pieces tested. Two samples taken from warp and two from filling of each piece.

Samples 2″ wide and 10″ long between the jaws of the testing machine.

Elongation taken on 8″ gauged length.

Marks.	Direction tested.	Elongation in 8″.	Tensi strengt
		Inches.	*Pound*
Field and siege	Warp	1.42	11
	.....do	1.52	1
	Filling	1.32	1
	.....do	1.27	[illegible]
Seacoast	Warp	2.00	1
	.....do	1.93	1
	Filling	1.03	1
	.....do	.95	1

ADDITIONAL TESTS.

Field and siege	Warp	1.60	1
	.....do	.68	10
	.....do	1.70	11
	Filling	1.44	11
	.....do	1.40	1
	.....do	1.46	1

TENSILE TESTS OF PAPERS.

For records and blue-printing purposes.
Samples 1″ wide by 3″ long, free length.
Duplicate samples taken out side by side.

Description.	Thickness.	Tensile strength.	
		Total.	Per square inch.
	Inch.	*Pounds.*	*Pounds.*
Byron Weston Co.'s linen, 48″ x 72″, 600 pounds	.0090	49.0	5,440
		49.5	5,500
Byron Weston Co.'s linen, 27″ x 40″, 125 pounds	.0071	48.5	6,830
		47.0	6,620
Byron Weston Co.'s linen, 23″ x 28″, 65 pounds	.0059	55.0	9,320
		54.5	9,240
Crane & Co.'s artificial parchment, No. 56	.0072	42.5	5,900
		45.0	6,250
Crane & Co.'s parchment deed, No. 44	.0058	36.5	6,290
		37.0	6,380
Crane & Co.'s parchment deed, No. 31	.0041	28.0	6,830
		27.5	6,710
Johannot (Frost & Adams, Boston, Mass.), 70 grams	.0034	19.5	5,740
		19.0	5,590
Johannot (Frost & Adams, Boston, Mass.), 110 grams	.0033	32.0	9,700
		31.5	9,550
"Columbia" (Keuffel & Esser, New York), No. 224	.0046	25.5	5,540
		27.0	5,870
"Hyperion" (Eugene Dietzgen & Co., Chicago)	.0050	21.5	4,300
		21.0	4,200

CHEMICAL ANALYSES.

BRONZE AND HEIDEL'S METAL.

Description.	Cu.	Sn.	Zn.	Al.	Fe.	Si.
Counter recoil buffer, 12″ disappearing carriage	57.49	0.44	42.07	Trace.		
Heidel's metal				99.20	0.28	0.48

STEELS FROM SPRINGFIELD ARMORY.

No. of tension test.	Description.	Marks.	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Nickel.	Tungsten.
	Rifle barrel steel.	M. B. S.	0.400	1.157	0.270	0.038	0.141	1.189		
10290	.....do	M. 3 A.	0.420	0.645	0.260	0.040	0.045	0.044		
10291	.....do	M. 3 A.	0.394	1.164	0.265	0.041	0.140	1.200		
10292	.....do	M. 3 A.	0.416	0.620	0.268	0.042	0.042	0.045		
10293	.....do	M. 3 A.	0.420	0.632	0.262	0.040	0.047	0.042		
10294	.....do	M. 3 A.	0.421	1.170	0.263	0.041	0.142	1.189		
10295	.....do	M. 3 B.	0.394	1.164	0.263	0.040	0.145	1.208		
10296	.....do	M. 3 B.	0.398	1.167	0.270	0.041	0.142	1.213		
10297	.....do	M. 3 B.	0.407	1.163	0.260	0.039	0.140	1.196		
10298	.....do	M. 3 B.	0.390	1.170	0.269	0.039	0.138	1.213		
10299	.....do	M. 3 B.	0.382	1.149	0.265	0.038	0.142	1.205		
10300	.....do	M. 3 C.	0.390	1.145	0.263	0.041	0.142	1.194		
10301	.....do	M. 3 C.	0.412	1.151	0.255	0.038	0.144	1.213		
10302	.....do	M. 3 C.	0.416	1.149	0.250	0.042	0.145	1.204		
10303	.....do	M. 3 C.	0.409	1.155	0.261	0.038	0.140	1.189		
10304	.....do	M. 3 C.	0.402	1.140	0.261	0.039	0.142	1.196		
7387	.....do	M. 3 A.	0.398	1.159	0.266	0.040	0.142	1.205		
7388	.....do	M. 3 A.	0.409	0.632	0.266	0.040	0.039	0.045		
7389	.....do	M. 3 B.	0.402	1.142	0.263	0.038	0.140	1.197		
7390	.....do	M. 3 B.	0.416	1.140	0.263	0.039	0.141	1.205		
7391	.....do	M. 3 C.	0.400	1.153	0.267	0.039	0.143	1.189		
7392	.....do	M. 3 D.	0.398	1.160	0.265	0.040	0.140	1.185		
7393	.....do	M. 3 A.	0.412	1.152	0.267	0.042	0.141	1.202		
7394	.....do	M. 3 A.	0.414	1.157	0.266	0.039	0.140	1.213		
7395	.....do	M. 3 B.	0.408	1.160	0.266	0.038	0.143	1.193		
7396	.....do	M. 3 B.	0.415	1.155	0.265	0.039	0.140	1.185		
7397	.....do	M. 3 C.	0.420	0.640	0.268	0.039	0.042	0.045		
7398	.....do	M. 3 C.	0.416	1.151	0.265	0.038	0.140	1.196		
7399	.....do	M. 3 D.	0.412	1.160	0.265	0.040	0.141	1.194		
7400	.....do	M. 3 D.	0.414	1.159	0.268	0.040	0.141	1.196		
7401	.....do	M. 3 D.	0.412	1.155	0.265	0.039	0.140	1.200		
	Receiver steel	No. 11.	0.320	0.933	0.062	0.035	0.090			
	Bolt steel	No. 8.	0.560	0.875	0.122	0.038	0.020			
	.....do	Champion.	1.160	0.300	0.176	0.005	0.003			0.956
	.....do		1.085	0.410	0.134	0.015	0.005			
	"New Gate"		0.270	0.680	0.257	0.050	0.063			
	"Old Gate"		0.160	0.360	0.018	0.054	0.070			

WROUGHT IRON.

	Common refined		0.060	Trace.	0.250	0.010	0.200			
	Best puddled		0.06	Trace.	0.240	0.010	0.191			
	Burden's best		0.078	Trace.	0.114	0.007	0.080			
	Norway		0.080	Trace.	0.007	0.006	0.076			

MISCELLANEOUS STEELS.

7304	Jacket, 6″ B. L. R. F. gun.	6 R F 36 J M T 1 O	0.400	0.600	0.250		0.012			
7306	Jacket, 12″ mortar.	17796 B 4 M T 2 M	0.480	0.672	0.208	0.025	0.015			
7307	Outer base, 15-pdr. gun.	D 83 O B 15	0.500	0.550	0.157	0.067	0.020			
7311	Inner base, 15-pdr. gun.	A 102 I B 15	0.470	0.620	0.200	0.058	0.040			
7313	.....do	A 104 I B 15	0.490	0.581	0.210	0.050	0.037			
	Obturating spindle.		0.350	0.717	0.024	0.030	0.020		3.144	

Private Tests.

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR ENDED JUNE 30, 1901.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1900.				
July 3	Motor tires	International Automobile and Vehicle Tire Co.	Newton	Mass.
6	Cast iron	Boston Elevated Railway Co	Boston	Mass.
	Cast rail joints	The Calumet Electric Street Railway Co.	Chicago	Ill.
9	Steel plates	Boston Elevated Railway Co	Boston	Mass.
17	Motor tire	International Automobile and Vehicle Tire Co.	Newton	Mass.
19	Cast iron	Walworth Manufacturing Co	Boston	Mass.
	Steel bars	Standard Roller Bearing Co	Philadelphia	Pa.
23	Adhesion of spikes	Ira Copeland	Newton	Mass.
24	Steel specimen	Savage Arms Co	Utica	N. Y.
Aug. 8	Canton flannel	E. J. H. Estabrook	Boston	Mass.
	Wire rope	George Lawley & Son Corporation	do	Mass.
11	Cast iron	American Ordnance Co	Lynn	Mass.
22	Sandstone	F. A. Haines	Deadwood	S. Dak.
	Band steel	National India Rubber Co	Bristol	R. I.
31	Rivet steel	Boston Elevated Railway Co	Boston	Mass.
Sept. 5	Granite cubes	Bay State Seam Face Granite Co	do	Mass.
12	Steel specimen	Savage Arms Co	Utica	N. Y.
13	Iron specimen	Houghton & Richards	Boston	Mass.
	Rivet steel	Boston Elevated Railway Co	do	Mass.
14	Soft steel	American Ordnance Co	Lynn	Mass.
21	Aluminum	Clarence B. Denny	Boston	Mass.
	Malleable iron	Boston Elevated Railway Co	do	Mass.
Oct. 5	Rivet steel	Boston Elevated Railway Co	Boston	Mass.
	Boiler plate	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
6	Belting	The Carton Belting Co	Quincy	Mass.
9	Carriage wheels	S. R. Bailey & Co	Amesbury	Mass.
12	Lava stone	John G. Kerr	Denver	Colo.
19	Sandstone	John L. Burke	Hot Springs	S. Dak.
25	Blocks and straps	Boston and Lockport Block Co	Boston	Mass.
26	Manila rope	Durand Woodman	New York	N. Y.
Nov. 1	do	Standard Rope and Twine Co	Boston	Mass.
8	Concrete prisms	Boston Transit Commission	do	Mass.
12	Granite	Pigeon Hill Granite Co	Rockport	Mass.
13	Hydraulic gauges	The Ashton Valve Co	Boston	Mass.
16	Canvas belting	The Carton Belting Co	Quincy	Mass.
26	Cordage	The Standard Rope and Twine Co	Boston	Mass.
27	Wire rope	The Lincoln-Dillaway Co	do	Mass.
30	Cement partition blocks.	The Venesia Fire Proofing Co	do	Mass.
Dec. 12	Mild steel	American Ordnance Co	Lynn	Mass.
	Cast steel	Stanley Manufacturing Co	Lawrence	Mass.
13	Columns	Lally Patent Column Co	Waltham	Mass.
18	Paving bricks	John Medway	Boston	Mass.
19	Benedict nickel tubing.	Benedict & Burnham Manufacturing Co.	do	Mass.
20	Paving bricks	John Medway	do	Mass.
22	Tubing	Benedict & Burnham Manufacturing Co.	do	Mass.
1901.				
Jan. 7	Mild steel	American Ordnance Co	Lynn	Mass.
	Steel specimen	Savage Arms Co	Utica	N. Y.
8	Saw blades	E. C. Atkins & Co	Indianapolis	Ind.
8	Cast iron	Boston Elevated Railway Co	Boston	Mass.
10	Rubber belting	Revere Rubber Co	Chelsea	Mass.
	Adhesion of concrete to steel.	Boston Transit Commission	Boston	Mass.
17	Bale rope	Hinckley Brothers & Co	do	Mass.
19	Adhesion of concrete to steel.	Boston Transit Commission	do	Mass.
24	Steel bars	The Marlin Fire Arms Co	New Haven	Conn.
28	Cement	Boston Transit Commission	Boston	Mass.
29	Rubber belting	Revere Rubber Co	Chelsea	Mass.
Feb. 1	Gauges	Star Brass Manufacturing Co	Boston	Mass.
	Belting duck	J. H. Lane & Co	do	Mass.
2	Steel bars	American Ordnance Co	Lynn	Mass.
7	do	do	do	Mass.
8	Gauges	Star Brass Manufacturing Co	Boston	Mass.
11	Steel balls	The Chapman Double Ball Bearing Co.	do	Mass.

Tests made for private parties during the fiscal year ended June 30, 1901—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1901.				
Feb. 14	Rubber belting	Revere Rubber Co	Chelsea	Mass.
	Buoy shackles	Fletcher & Crowell Co	Portland	Me.
25	Steel bar	The Marlin Fire Arms Co	New Haven	Conn.
26	Cast-iron push bars	Boston Transit Commission	Boston	Mass.
	Sandstone	F. M. Marsh	Omaha	Nebr.
Mar. 11	Wall tie	Henry G. Lamburn	Boston	Mass.
12	Shackles	Fletcher & Crowell Co	Portland	Me.
	Cast-iron man-hole covers.	New England Telephone and Telegraph Co.	Boston	Mass.
13	Steel	American Ordnance Co	Lynn	Mass.
15	Hammered steel bars.	Kinsley Iron and Machine Co	Canton	Mass.
16	Buoy shackles	Fletcher & Crowell Co	Portland	Me.
	Cast-iron push bars	Boston Transit Commission	Boston	Mass.
21	Stockinet	Hood Rubber Co	Watertown	Mass.
26	Swivel	Fletcher & Crowell Co	Portland	Me.
28	Paving bricks	Ferris Brick Co	Cambridge	Mass.
Apr. 4	Poncho cloth	J. H. Lane & Co	Boston	Mass.
9	Cast-iron push bars	Boston Transit Commission	do	Mass.
10	Steel balls	The Chapman Double Ball Bearing Co.	do	Mass.
15	Anchor bolt	F. A. Houdlette & Son	do	Mass.
	Rubber belting	Revere Rubber Co	Chelsea	Mass.
18	Steel bands	National Fire Proofing Co	Boston	Mass.
23	Blocks	Boston and Lockport Block Co.	do	Mass.
	Gauges	The Watson-Stillman Co	New York	N. Y.
25	Cloth	Hood Rubber Co	Watertown	Mass.
29	Granite cubes	City of Cincinnati	Cincinnati	Ohio.
	Steel balls	The Chapman Double Ball Bearing Co.	Boston	Mass.
May 2	Stone cubes	H. L. Thornton	Cincinnati	Ohio.
6	Tackle blocks	Herreshoff Manufacturing Co	Bristol	R. I.
7	Steel plate	Cunningham Iron Co	Boston	Mass.
9	Bronze	Boston and Lockport Block Co	do	Mass.
14	Studded links	Bradlee & Co	Philadelphia	Pa.
	Rope	Durand Woodman	New York	N. Y.
17	Hooks and swivel head.	Boston and Lockport Block Co	Boston	Mass.
	Spliced rope	Hood Rubber Co	Watertown	Mass.
	Turn buckles	Fitch & Co	Boston	Mass.
18	Hammock duck	Fearing, Whiton & Co	do	Mass.
28	Couplings	Boston Transit Commission	do	Mass.
	Steel bar	Concord Axle Co	Penacook	N. H.
29	Marble	Vermont Marble Co	Proctor	Vt.
June 8	Steel plate	Merrimac Chemical Co	North Woburn	Mass.
11	Steel bars	Boston Elevated Railway Co	Boston	Mass.
12	Anchor bolt	F. A. Houdlette & Son	do	Mass.
	Wall ties	H. G. Lamburn	do	Mass.
14	Shotgun barrel	Remington Arms Co	New York	N. Y.
	Bronze	Charles B. Wetherbee	Bath	Me.
25	Shackles	Fletcher & Crowell Co	Portland	Me.
29	do	do	do	Me.

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